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June 9, 2014

Ms. Betsy Burns
Remedial Project Manager
US EPA, Region 8 Montana Office
Federal Building
10 West 15th Street, Suite 3200
Helena, MT 59626

Subject: East Helena Superfund Site Remedial Design
Residential Soil Sampling Field Sampling Plan, Revision 1
Work Assignment No. 132-RDRD-0830
Contract No. EP-W-06-006

Dear Ms. Burns:

Pacific Western Technologies, Ltd. (PWT) is pleased to submit the Residential Soil Sampling Field Sampling Plan, Revision 1 for the East Helena Superfund Site, East Helena, Montana. The Plan is relevant for actions pursuant to the Statement of Work for Remedial Design sampling activities performed by PWT.

If you have any questions or comments regarding this submittal, please do not hesitate to contact me by phone at (406) 457-5495 or email at greg.hayes@PWT.com.

Sincerely,

Greg Hayes, Project Manager
Pacific Western Technologies, Ltd.

Attachments: Residential Soil Sampling Field Sampling Plan

East Helena Superfund Site
Residential Soils and Undeveloped Lands Operable Unit 2
Lewis and Clark County, Montana

REMEDIAL DESIGN
RESIDENTIAL SOIL SAMPLING
FIELD SAMPLING PLAN

Prepared for:

U.S. Environmental Protection Agency

Region VIII
10 West 15th Street, Suite 3200
Helena, Montana 59626

Revision 1

Work Assignment No.	132-RDRD-0830
U.S. EPA Contract No.	EP-W-06-006
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Date:	June 9, 2014

East Helena Superfund Site
Residential Soils and Undeveloped Lands Operable Unit 2
Lewis and Clark County, Montana

Remedial Design
Residential Soil Sampling
Field Sampling Plan

Revision 1

Work Assignment No. 132-RDRD-0830
U.S. EPA Contract No. EP-W-06-006

June 9, 2014

Prepared by: _____ Date: 6/9/2014
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Project Manager, PWT

Approved by: _____ Date: 6/9/2014
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Document Revision Log

Revision	Date	Primary Changes
0	9/27/13	New Document to EPA for review
1	5/5/14	Revised to Incorporate EPA comments
1	6/9/14	Revised to Incorporate EPA comments

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LIST OF ACRONYMS

CLP	U.S. Environmental Protection Agency Contract Laboratory Program
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
LEAP	Lewis & Clark County Lead Education and Abatement Program
QAPP	Remedial Design Quality Assurance Project Plan
OU2	Operable Unit 2
PWT	Pacific Western Technologies, Ltd.
ROD	Record of Decision
Site	East Helena Superfund Site OU2
SOP	standard operating procedure

1.0 INTRODUCTION

The East Helena Superfund Site consists of the decommissioned ASARCO smelter, an industrial facility operated by American Chemet Corporation, all of the City of East Helena, Montana, nearby residential subdivisions, numerous rural developments such as homes on small acreage plots and several large farms or ranches and their associated cultivated fields or pastures, including land in both Lewis and Clark County and Jefferson County (Figure 1). The U. S. Environmental Protection Agency (EPA) Site Identification Number for the East Helena Superfund Site is MTD006230346.

Activities relating to this Field Sampling Plan (FSP) are being conducted in accordance with the *Final Record of Decision, East Helena Superfund Site, Operable Unit No. 2, Residential Soils and Undeveloped Lands* (ROD) (USEPA 2009). As described in the ROD, the selected remedy addresses Operable Unit 2 (OU2), East Helena Residential Soils and Undeveloped Lands, which consist of non-smelter property soils of residential areas, rural developments, and surrounding agricultural land.

This document serves as the Residential Soil Sampling FSP to supplement Pacific Western Technology's (PWT) *Remedial Design East Helena Superfund Site, Residential Soils and Undeveloped Lands (OU2) Soil Sampling Program Quality Assurance Project Plan (*QAPP) (PWT 2013a) for the remedial design assessment at OU2. The objective of the QAPP is to establish the data objectives to ensure appropriate quality of soil samples necessary to complete a remedial design on any properties for which remediation is required based on action levels established in the ROD. The QAPP also provides definitions of the project data quality requirements necessary to meet the data objectives for these field programs. Details of the QAPP will not be repeated here.

As discussed in Section 5.0 of the QAPP (PWT 2013a), this FSP includes the details of the residential soil sampling design for the remedial design activities in accordance with Work Assignment 132-RDRD-0830. The details of the sampling design described in this FSP include the justification for the delineation of residential sampling units, location of sampling points within each sampling unit, number of samples collected, depth intervals from which samples are collected, field schedule, and contingencies for inaccessible sampling locations.

2.0 SAMPLING DESIGN

2.1 SOIL SAMPLING

Under this FSP, composite soil samples will be collected in general accordance with the EPA's *Superfund Lead-Contaminated Residential Sites Handbook* (USEPA 2003). Samples will be collected from three depth intervals, 0 to 1 inches, 1 to 6 inches, and 6 to 7 inches below ground surface. PWT anticipates the collection of soil field samples for analysis of lead and arsenic from approximately 30 properties during the period of performance of Work Assignment 132-RDRD-0830, which spans from August 5, 2013 to December 31, 2015. There are thirteen residential properties with property owners who have requested EPA soil sampling in 2014 or 2015. These are properties that have not been sampled in the past for various reasons including lack of access agreements with the property owners. Based on discussions with the EPA and the Lewis and Clark County Lead Education and Abatement Program (LEAP), PWT estimates that approximately 30 total residential properties that have historically denied access for sampling may request EPA soil sampling between October 2013 and December 2015. While the number of residential yards ultimately sampled will depend on the number of access agreements secured by the EPA and its contractor, PWT, a preliminary list of properties where the property owner has requested EPA sampling is presented on Table 1. The locations of these properties are displayed on Figure 2. As additional properties become available for sampling, Table 1 and Figure 2 will be amended to include these new properties. If more than one habitable dwelling exists on a property, the PWT team will divide the property into multiple yards and sample accordingly (i.e. sampling units will be designated around each habitable dwelling, irrespective of property boundaries).

2.2 STANDARD OPERATING PROCEDURE FOR SAMPLING ACTIVITIES

The PWT Standard Operating Procedures (SOPs) included in Appendix A describe the process for spatial data submittals, soil sample handling, borehole logging, utility clearance, investigation derived waste management, decontamination, and soil sample collection and shipment. Unless otherwise described in this FSP, the physical sampling will be carried out in accordance with PWT's Surface Soil Sampling for Inorganics SOP (PWT-ENSE-427). All referenced SOPs are included in Appendix A of the QAPP (PWT 2013a) and in Appendix A of this FSP.

Residential Yard Sampling

Composite soil samples will be collected during the residential yard soil sampling effort. Samples from each sampling unit of the residential yard (e.g., front yard, back yard, play area) will be collected from three depth intervals in accordance with PWT's Surface Soil Sampling for Inorganics SOP (PWT-ENSE-427) and prepared and shipped to the EPA Contract Laboratory Program (CLP) laboratory for analysis per PWT's Sample Handling SOP (PWT-ENSE-406). Number of subsamples and subsample locations within each sampling unit in a residential yard will be determined based on the surface area to be represented, as described in the EPA's *Superfund Lead-Contaminated Residential Sites Handbook* (USEPA 2003), and based on past sampling methodologies at OU2, as described in the *Sampling and Analysis Plan* portion of the *Work Plan for Excavation and Removal of Residential Soils, East Helena, Montana* (Hydrometrics 1991), and the associated Removal Administrative Order on Consent (USEPA 1992) as modified. A yard area (front, back, or side) will be defined from the structure to the property boundary, including a maximum of 125 feet from the furthest point out on the home (e.g., outside wall, porch, or deck) unless a physical boundary such as a fence, hedge, or abrupt change in grade is encountered.

For each residential property, PWT will generate a figure prior to arriving for sampling activities that includes the aerial image of the property. This figure will not be generated from a professional land survey, but from a satellite image, and will be used in conjunction with a field sketch to determine the sampling units present. The sampling units will be determined based on site reconnaissance, and will occur while the PWT field team is physically onsite the day of sampling.

Upon arrival at a property to be sampled, the PWT team will complete a site walk through of the property to identify any hazards present at the site, including dogs or other biological hazards, low hanging electrical wires, unstable structures or trees, uneven ground causing tripping hazards, or any other hazardous situation not mentioned here. If the sampling location is deemed unsafe by any member of the PWT field team, the circumstances will be noted on the field sampling form and in the field logbook and they will notify the PWT Field Team Leader (also the Project Manager) for instructions before proceeding. All safety procedures established in the PWT *East Helena OU2 Site-Specific Health and Safety Plan* (PWT 2013b) will be followed.

PWT does not anticipate the need to enter into houses or other structures to complete the sampling, but if this does become necessary, PWT will revise the health and safety plan to address the unique sensitivities associated with these situations.

During the site walk through, the PWT field team will designate sample units and subsample locations, as described in Section 2.2.2 of this FSP.

2.2.1 Residential Soil Sampling Packet

For each individual residential property scheduled for sampling, PWT will generate a Residential Soil Sampling Packet, consisting of a Sampling Field Form, a Field Diagram of the Property (a separate one

will be developed for each individual property, and will consist of an aerial image of the entire property to aid the PWT Field Team), as well as a blank Field Sampling Property Sketch Form. This blank form will be used to sketch the sampling units for that particular property, as well as to mark the subsample locations within each sampling unit. The items that will be completed on the field sketch of the property will include:

- Property address and PWT location code
- Date and times of sample collection
- Sampling unit designation (e.g., Front Yard, Back Yard, Play Area, etc.) and borders
- House and other structure locations
- Playground equipment installed in yards
- Subsample locations, including Drip Zone
- Surface area of each sampling unit.

Photographs will be taken of every yard component and any unusual features. All information will be recorded in the field logbook and photo log, including any deviations from the QAPP (PWT 2013a), this FSP, or SOPs.

An example of a typical Residential Soil Sampling Packet, including a Sampling Field Form, a Typical Field Diagram of a Property, and a blank Field Sampling Property Sketch Form for use in sketching the sample units and subsample locations, is included as Appendix B of this FSP. A separate Residential Soil Sampling Packet will be generated for each property to be sampled during the sampling event preparation period.

2.2.2 Sample Density, Location, and Compositing

For each Non-Drip Zone sampling unit (e.g, Front Yard, Backyard, Play Area, etc.), five subsamples will be collected and composited from each depth to provide adequate representation, unless the sampling unit is less than 500 square feet. If the sampling unit is less than 500 square feet, only two subsamples will be collected and composited from each depth. This 500 square feet measurement cutoff has been established by PWT to ensure that representative composite samples are collected from each sampling unit, while also ensuring that a smaller sized sampling unit sample (e.g., a small flower garden or play area) is not obtained through compositing an excessive amount of subsamples compared with the overall area. Measurements will be made in the field by the PWT field team, and decisions relating to any deviations from the standard number of subsamples per sampling unit will be made by the Field Team Leader, who will document the reasons for the deviation in the field logbook and the field soil sampling form. Non-Drip Zone sampling unit categories include Front Yard, Backyard, Side Yard, Play Area, Driveway/Bare Area, Garden, and Opportunity. Opportunity samples may be collected at any property at any time during the sampling investigation if the PWT field team members identify an aspect of the property posing an exposure route to humans that is not otherwise being sampled.

For Drip Zone sampling units, a four-point composite will be collected using soil from the drip zone on each side of the residence. The drip zone subsample locations will be collected from an area between 6 and 30 inches from the exterior of the house, near the midpoint of each side of the house, if possible. For properties with inaccessible drip zones (e.g., concrete walkway, brick patio, etc.), fewer than four subsamples may be composited for a sample from each depth. Additional subsamples may be collected for the drip zone composite sample if other factors exist, such as bare spots and areas where roof runoff clearly collects.

For any sampling unit at a given property, if there are locations which are inaccessible for reasons including a locked fence or gate, excessive vegetation, or any other reason, the PWT Field Team Leader will make a reasonable attempt to coordinate with the property owner, and collect the sample from the

inaccessible location. If the collection of a sample from that location is not possible, the deviation will be noted on the field forms and in the field logbook, and photographs will be taken to document the inaccessibility.

Composite samples will be the result of combining discrete subsamples from each depth from locations spaced throughout each sample unit. Subsamples will be collected into one clean container, such as a stainless steel bowl or plastic disposable bowl, and thoroughly mixed. While mixing the soil, any large gravel-sized particles will be excluded from the sample container (USEPA 2003). For samples made of subsamples collected from a five point composite, an equal amount of soil, 2 ounces, will be collected from each subsample location. For investigative samples made of subsamples collected from a composite less than five points, an approximately equal amount of soil will be collected from each subsample location to total 8 ounces. After mixing, the sample will be placed in one 8 ounce glass jar, labeled, and stored in a cooler at a temperature of 4 degrees Celsius and in proper custody until it is delivered to the assigned EPA CLP laboratory. For investigative samples which have been designated as matrix spike samples for laboratory quality control purposes, double the amount of soil will be collected from each subsample location, thoroughly mixed, and then split into two 8-ounce jars. Any additional sample volume will then be disposed in the sample holes before backfilling occurs. Sampling equipment will be decontaminated or disposed of in accordance with PWT's Personnel and Equipment Decontamination SOP (PWT-ENSE-424).

2.2.3 Sample Depths

Samples will be collected from three distinct depths, from 0 to 1 inch, 1 to 6 inches, 6 to 7 inches below ground surface. Based on the results of past deep sampling at OU2, as well as on previous removal action practices from areas outside the highly contaminated area directly adjacent to the smelter site, only sample results from the 0 to1 inch depth interval will be used to determine if the property qualifies for remediation. While the 1 to 6 inch and 6 to 7 inch intervals will be used to aid in the remedial design of the qualifying residential properties, specifically to guide the depth of excavation, the 1 to 6 inch interval also will also warrant further evaluation of the property if the results are above the ROD established action levels of 1000 ppm lead or 100 ppm arsenic. This further evaluation may include additional sampling.. If grass or any other non-soil ground cover is present (e.g., wood chips, sand, rocks, etc.) the 0 to1 inch sample will be collected from immediately below that cover, except when the sample location falls on a graveled driveway or similar surface containing soil/dust material on the surface.

Opportunity samples may be collected from areas not mentioned above where there is an elevated risk of human exposure. Any decisions regarding the collection of these opportunistic samples will be made in the field by the PWT field team and/or EPA personnel, and documented in the field logbook.

2.2.4 Utilities

Prior to any intrusive work, both underground and overhead utilities will be located in accordance with PWT's Utility Clearance SOP (PWT-ENSE-413). Underground utilities, including natural gas, telecommunications, water and sewer, electrical, fiber optics and cable, will be located and marked by the relevant utility companies prior to intrusive field sampling activities. Property owners will also be consulted for any underground utilities or features. Overhead utilities will be visually cleared for hazardous conditions, such as low hanging wires, by PWT's Field Team Leader prior to sampling activities at the property.

2.2.5 Sample Identification

Samples collected in accordance with this FSP will be identified through the use of a coding system to indentify sample locations and sample types. The coding system will ensure that samples are uniquely identified by sample number and provide tracking numbers to facilitate data retrieval. Since data collected pursuant to this FSP will eventually be added to the master East Helena analytical database that is housed in the offices of LEAP, PWT will use as much of the historic naming convention as possible while still allowing for proper classification of sampling units and sample types.

Since the samples collected pursuant to this FSP are not part of a removal action or the continuous monitoring program, PWT will not use the existing categories of PST (post-removal sampling), PRE (pre-removal sampling), or CM (continuous monitoring) for the Sample Type category. Instead, PWT will assign a Sample Type of RD indicating samples collected in accordance with this FSP are for the purpose of completing the remedial design.

The naming convention used in the past at the Site includes a Site Code, which is a series of two letters and a two digit number. The first letter is the geographic grid name, the second letter is the subgrid name, and the number is the unique, two digit property number within that grid/subgrid combination. PWT will continue to use this naming convention for the Site Code.

Historical sample data from the Site has used a number to define which sampling unit at a property the sample was collected from. The number then had to be cross-referenced with the field form in order to determine where the sampling unit was located on the property. For this sampling, PWT will depart from this convention so that the Sample Number field in the database contains more descriptive information. Therefore, instead of using the number 1 if a sample was collected from the first sampling unit, PWT will use a specific sampling unit code such as FY for front yard or BY for the backyard. A complete list of these sampling unit codes can be found below, as well as in Table 2.

Additionally, the historical data did not contain the sample depth within the Sample Number itself. For sampling conducted pursuant to this FSP, PWT will assign the depth as a four digit number (e.g., 0001, 0106, or 0607).

PWT will use the following identification numbering scheme for each EPA soil sample from the residential yard soil samples.

Sample Type:	RD – EPA Remedial Design soil sample
Site Code:	ZD01 – Property sampled corresponding to historical EPA property identifiers, meaning the property is named property "01", within the pre-assigned subgrid "D" in the larger grid "Z"
Sampling Unit:	FY – front yard
	BY – back yard
	SY – side yard
	GA –garden (flower/vegetable/fruit)
	PA – play area
	BA – bare area/driveway
	DZ – drip zone
	OP – opportunity sample
Depth Intervals:	0001 – 0 to 1 inch bgs
	0106 – 1 to 6 inches bgs
	0607 – 6 to 7 inches bgs
Quality Control:	R – Replicate

For example, the identification number RD-ZD01-BY-0006 indicates that the EPA remedial design soil sample is from the residential yard assigned the unique site code of ZD01, and that the sample was collected from the back yard of this residential property from the 0 to 6 inch bgs interval. If a quality control replicate sample is also collected from this same location and interval the letter "R" would be added to the sample number immediately after the depth interval (RD-ZD01-BY-0006R).

2.2.6 Project Team/Organization

Mr. Greg Hayes is the Project Manager and main point of contact for the PWT Team, including partnering companies and any subcontractors. Mr. Hayes will be responsible for day-to-day communication with the EPA Remedial Project Manager (RPM) as well as with the PWT Team staff assigned to perform various project tasks. He will be responsible for the contractual commitments and for ensuring that the necessary resources are dedicated to the project.

Ms. Betsy Burns is the EPA RPM and the primary EPA contact for all aspects of the work concerning Operable Unit 2 – Residential Soils and Undeveloped Lands. Ms. Burns has overall responsibility for this portion of the project and also is responsible for coordinating communication between the EPA, the state, and the public. As RPM, Ms. Burns will communicate directly with the PWT Team Project Manager, Mr. Greg Hayes, and as necessary with the PWT Team RAC2 Region 8 Contract Program Manager, Dr. Ram Ramaswami.

Other relevant members of the project organization are discussed in Section 2.0 of the QAPP (PWT 2013a).

2.3 FIELD QUALITY CONTROL SAMPLES

The QAPP (PWT 2013a) that accompanies this FSP details the field quality control samples necessary to ensure quality data is gathered in section 9.1. Table 3 in this FSP lists the sampled media, analysis, anticipated concentration range, laboratory reporting limits, action levels, laboratory, analytical method, sample type, related quality control and quality assurance samples proposed, sample volume, sample preservation and holding times, container type and total number of analyses.

2.4 SCHEDULE

An estimated 30 residential properties are anticipated to be sampled in accordance with this FSP. Thirteen properties are expected to be sampled in 2014, and the remaining properties will be sampled in 2015, as property owners request sampling and access agreements are obtained. All samples will be evaluated and validated in accordance with the functional guidelines presented in the QAPP. After the data validation and verification has occurred, the sample results will be reported to each individual property owner and a Data Summary Report, summarizing all data collected, will be prepared. The sample results will also be added to the master database that is housed in the East Helena LEAP office.

2.5 EPA ANALYTICAL PROGRAM

The EPA's analytical program will provide analytical services for the soil sampling activities pursuant to the QAPP (PWT 2013a). Only CLP Laboratories will be used. The CLP Laboratory will be assigned by the EPA Analytical Services Coordinator. Requirements for laboratory instrument calibration, documentation, and periodic maintenance schedule will be in accordance with the contract between the assigned laboratory and the EPA. Adherence to these contract requirements is monitored by the EPA Analytical Services Coordinator. A complete description of the EPA's analytical program can be found at: http://www.epa.gov/superfund/programs/clp/index.htm. All CLP laboratories follow the same QA/QC program. The statement of work for the CLP's Inorganic analytical method, ISM01.3, which will be utilized for this project, can be found at: http://epa.gov/superfund/programs/clp/ism1.htm. These

statement of work documents constitute the technical and contractual framework for commercial environmental testing laboratories to apply analytical methods for the isolation, detection and quantitative measurement of environmental samples. This includes a summary of requirements, reporting and deliverable requirements, a target compound list and contract required quantitation limits, analytical methods, quality assurance/quality control requirements, chain-of-custody, document control, and SOPs, a glossary of terms, and a data dictionary and format for data deliverables in computer-readable format. The EPA analytical program pre-defines elements such as analytical methods, laboratory equipment maintenance and calibration, sample shipment chain-of-custody procedures and forms, analytical precision and accuracy, sample disposal procedures, quality control requirements, data management, and documentation. More detailed descriptions of these elements of the EPA analytical program can be found within the ISM01.3 statement of work documents. If problems arise, PWT will immediately contact the EPA Analytical Services Coordinator. The EPA's Analytical Services Coordinator will communicate directly with the EPA RPM as well as with the assigned laboratory.

All soil and water (rinsate) samples collected in accordance with this FSP will be sent to a lab included in the EPA's CLP analytical program, and will be analyzed by EPA CLP method Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) equivalent to Method 6010. Though the contaminants of concern are arsenic and lead, this analytical method will analyze for and report concentrations of the following analytes: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. Table 3 in this FSP lists sampled media, analysis, anticipated concentration range, laboratory reporting limits, action levels, laboratory, analytical method, sample type, related quality control and quality assurance samples proposed, sample volume, sample preservation and holding times, container type and total number of analyses.

2.6 EQUIPMENT AND SUPPLIES

Field equipment and supplies anticipated to be needed during this investigation are identified on Table 3 in the QAPP (PWT 2013a) along with acceptance/inspection, storage, and handling requirements for each item. No field equipment calibration is expected to be performed by the PWT field team.

3.0 REFERENCES

Hydrometrics. 1991. *Work Plan for Excavation and Removal of Residential Soils, East Helena, Montana.*

PWT. 2013a. *East Helena Superfund Site, Residential Soils and Undeveloped Lands (OU2) Draft Soil Sampling Program Quality Assurance Project Plan.* September.

PWT. 2013b. *East Helena Superfund Site, Residential Soils and Undeveloped Lands (OU2) Site-Specific Health and Safety Plan.* September.

USEPA. 1992. *Modification of the Administrative Order On Consent.*

USEPA. 2003. *Superfund Lead-Contaminated Residential Sites Handbook.*

USEPA. 2009. *East Helena Superfund Site, Operable Unit No. 2, Residential Soils and Undeveloped Lands, Final Record of Decision.* September.

APPENDIX A

STANDARD OPERATING PROCEDURES

PWT-ENSE-402 SPATIAL DATA SUBMITTALS

PWT-ENSE-406 SAMPLE HANDLING

PWT-ENSE-413 UTILITY CLEARANCE

PWT-ENSE-418-BOREHOLE LOGGING

PWT-ENSE-423 INVESTIGATION DERIVED WASTE MANAGEMENT

PWT-ENSE-424 PERSONNEL AND EQUIPMENT DECONTAMINATION

PWT-ENSE-427 SURFACE SOIL SAMPLING FOR INORGANICS

PWT STANDARD OPERATING PROCEDURE

SPATIAL DATA MANAGEMENT

Procedure No. PWT-ENSE-402
Revision 3
Date effective: 04/11/14

APPROVED: _____ 5/5/14
PWT Project Manager, Date

Contents

List of Attachments

Attachment A: U.S. EPA Region 8 GIS Deliverable Guidance

Attachment B: MetaData Entry Form

REVISION LOG		
Revision Number	**Description**	**Date**
1.1	Original SOP	September 2002
2.0	QA Review and Update	April 2012
3.0	Incorporate January 2014 EPA Guidance	March 2014

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**
2.0	Annual QA Review	August 2013

PWT STANDARD OPERATING PROCEDURE

SPATIAL DATA MANAGEMENT Procedure No. PWT-ENSE-402
Revision 3
Date effective: 04/11/14

APPROVED: _____ 5/5/14 Page 1 of 7
PWT Project Manager, Date

1.0 INTRODUCTION

This manual provides instructions for the management of spatial data by Pacific Western Technologies (PWT) on Environmental Protection Agency projects. All project managers and Geographic Information System (GIS) specialists should insure that spatial data is managed in a manner consistent with requirements in this SOP. In most cases this SOP applies to maps, drawings and other deliverables created in ESRI's ArcGIS software or Autodesk's AUTOCAD (CAD) software.

In general, there are three major components involved in the management of spatial data. The first phase occurs during project initiation. The second phase involves spatial data management activities during project implementation and the third phase involves spatial data submittals to EPA as part of project completion and /or closeout. The National Geospatial Data Policy (NGDP) establishes principles, responsibilities, and requirements for collecting and managing geospatial data used by the U.S. Environmental Protection Agency (EPA). Within EPA Region 8, GIS file delivery formats for all materials developed in support of CERCLA related site work are specified in the GIS Deliverable Guidance in Attachment A. All geospatial data that is collected, acquired, or managed in conjunction with an EPA project must comply with the requirements specified in this document.

2.0 SPATIAL DATA MANAGEMENT AT PROJECT INITIATION

It is often the case that upon receipt of a new project, the Project Manager will receive electronic files and/or documents that may include spatial data generated by a previous contractor or potentially responsible party (PRP). At this stage the project manager in conjunction with GIS/CAD specialists must determine the geographic coordinate system or projected coordinate system under which these data were produced. In cases where PWT will be generating all new deliverables on the project it is important to determine if the previous coordinate system should continue to be used on the project or whether the spatial data should be converted to a coordinate system that is more applicable to the project. Alternatively, on oversight projects where PWT will be receiving spatial data and deliverables from the PRPs or their contractors, maintaining spatial data in the same coordinate system as it was received is preferable. Maintaining spatial data in different coordinate systems should be avoided. In most cases, spatial data will be maintained and reproduced using the state plane projected coordinate system for the state in which the work is being performed. Unless stipulated otherwise, all data sources should use the appropriate State Plane Coordinate System with the following parameters defined:

COORDINATE SYSTEM:	State Plane [ex. Colorado]
ZONE:	State Specific [ex. Colorado Central]
DATUM:	ex. NAD83
SPHEROID:	ex. GRS80
UNITS:	Feet

2.1 DIRECTORY STRUCTURE

During project setup the project manager or designee should implement a project file structure that will contain the results of spatial and other data and deliverables on the project. The following folder structure incorporates the suggested folder structure in the GIS Deliverable Guidance and is improved to better handle PWT products and deliverables. The desktop and user areas on individual workstation should not be used to store project directories. The following project folder structure should be established for geospatial data and deliverables on each project:

Main Folder: **Project_Name** (ex. WA125 Vasquez Blvd. OU2). If the project is being conducted under multiple work authorizations (WAs), a more generic project name can be considered such as "Vasquez Blvd/I70 Superfund Site." Project related folders in addition to the folders used for geospatial data will also be located under the main folder.

Folder: **Geospatial_Info**: This directory holds all subfolders created below. It may also contain any work instructions or correspondence related to map or figure preparation.

Subfolder: **Images:** aerial photos, satellite imagery, logos, DEMs, and other raster type data

Subfolder: **Maps:** .MXDs and .PDF files). Map names should use the project name as a prefix

Subfolder: **Shapes:** geodatabases, shape files, and other approved vector data formats. All data used by mxds in the **Maps** directory should be located here. This insures data links and facilitates project portability.

Subfolder: **Drawings:** .DWG and .DXF files and other CAD related files

Subfolder: **Source:** original unmodified data that may have been acquired from external/internal sources

Subfolder: **Tables:** MS-Access databases, spreadsheets, delimited text files, or other such tabular data used to make maps or figures

Subfolder: **Archive:** storage for any previous versions of documents that are kept for reference

3.0 SPATIAL DATA MANAGEMENT DURING PROJECT EXECUTION

During project execution there will be a need to manage geospatial data and products in an effective manner so that the progression of data and deliverables can be identified and managed appropriately. The following subsections provide guidelines for proper geospatial data management.

3.1 FILE NAMING CONVENTIONS

File naming conventions need to be consistent to allow PWT staff to easily find related files for comparison, integration, or duplicate elimination. Each data source filename should include a project identifier prefix (RMA, USM, CMX, etc.) and a clear descriptor based on the map name. Each part of the filename may be separated by an underscore but special characters or spaces should not be used in filenames. For example, a map created for Rocky Mountain Arsenal may be identified as "RMA_OffpostTreatmentPlant.mxd," or CMX_Bldg1002.shp for a shapefile created for the

CEMEX project. Use a condensed version of the document title as the filename. (On some older systems a path and filename cannot exceed 256 characters combined.) Use capitalization to separate words. If it is necessary to distinguish a data source developed by an outside entity for public use from one developed for PWT directly, add an additional identifying prefix, i.e RMA_USGS_topo2012.shp or USM_TooeleCntyPLSS.mxd

3.2 SERIES or VERSION IDENTIFICATION

Maintaining successive versions of the same map or shapefile may be necessary because they may be included in succeeding versions of documents or handouts. The date of creation should be used in a MMDDYY format as a suffix for files. An example format may be "RMA_SplitSamples_120312" to identify a drawing, map or shapefile for groundwater split samples collected at Rocky Mountain Arsenal created in December 2012. For periodically collected data, where the same base map will be used to display temporally different information, a modified suffix can be used to distinguish one version of a map or shapefile from another. For example, for quarterly samples, the quarter can be substituted for the date such as RMA_NBCS_2011Q3_120312 for the third quarter treatment plant samples collected at the North Boundary Containment System in 2011 displayed on a map created in December 2012. Do not use words like new and old to describe versions. Once all previous versions have been discarded or moved to the Archive directory, PWT personnel can decide how to reconcile any edits and drop the date suffix from the final version that results. For example it is acceptable to substitute "dft", "dft_fnl" and "fin" for draft, draft_final, and final versions of figures or maps that correspond to the version of the document that was issued to the client. Final deliverable versions may also use the suffix "_REV0."

3.2.1 SUFFIX – CATEGORY

Categorical suffixes should be considered to classify the type of data in a given map or shapefile. If a data source fits two categories or falls into a category not yet defined, a new suffix should be developed with the consensus of the project manager. As an example, a shapefile or CAD drawing file using a categorical suffix might be RMA_Railyard_gw_091012.shp to identify groundwater data from the Railyard Extraction System at Rocky Mountain Arsenal. Example suffixes are listed below.

air – air sample locations

ast – above-ground storage tank

B### – building number to proceed name of environmental samples collected within a building

bh – borehole

bldg – building

bnd – boundary

cov – cap or cover

ctr – contours

elev – point elevations

exc – excavation

fnc – fence

gs - gas

gw – groundwater

OU# – operable unit identifier (such as OU3)

Q# – quarter (such as Q3 for third quarter)

prop – property map

rd – road

rr – railroad

sdwk – sidewalk

soil – soil

str – stream

sw – surface water

swr – sewer collection system features

stm – storm water collection system features

tel – telecommunication system features

tp – treatment plant

ust – underground storage tank

utl – utility

veg – vegetation

well - well

wl – water level

wtr – water distribution system features (e.g. domestic water line)

3.3 THE ARCGIS MAP DOCUMENT (*.mxd)

An ArcGIS map document (*.mxd) will be generated for each map produced for a project. All map documents should be stored in the ***Maps*** directory, either at the root level of the directory structure for sitewide projects, or within a subdirectory labeled with its project area (e.g. Lime Basins). All

maps must include a file path in the lower left corner. Insert text and paste 'Path: <dyn type="document" property="path"/>' into it. This will reference any resulting document to the mxd that created it. Include the date of any imagery used as a background in the legend. The map document will contain links to shapefiles used to make the map. If a shapefile is moved to a different subfolder than the one from which the shapefile was imported to the map, the link to this shapefile will be lost and will no longer be displayed on the map. To avoid this problem, all shapefiles should be located in the shapes subfolder. Each map or figure should contain a legend which provides, at a minimum, the following information:

1. Names of active shapefiles used in the map
2. North arrow and map scale, including units
3. Definition of symbols used on the map
4. Company logo and client logo (if available)
5. Map author and creation date
6. Map reviewer and approval date

3.4 THE ARCGIS SHAPEFILE (.shp)

All vector data sources used in ArcGIS are contained in shapefiles which will be defined as points, lines, or polygons and will have a .shp suffix at the end. However these shapefiles are actually composed of five to six separate files which combine to make the shapefile. These individual files should never be edited individually and all editing of the shapefile should be done in ArcMap, ArcCatalog or ArcToolbox. File corruption will result otherwise. All shapefiles should be stored in the ***Shapes*** project subfolder. The shapefiles can be stored as geodatabases or stand-alone. ArcGIS includes conversion tools in ArcCatalog and ArcToolbox that allow other formats to be converted into shapefiles for geodatabases; however, to ensure maximum convertibility, it is best to generate data directly as shapefiles in ArcMap.
Vector data that is used in GIS application must be in shapefile format. Do not store shapefile or personal geodatabases as zipped files as this sometimes corrupts the data.

3.5 THE CAD DRAWING FILE (.dwg)

A CAD drawing file (*.dwg) will be generated for each drawing produced for a project in CAD. All drawings should be stored in the ***Drawings*** directory, either at the root level of the directory structure for sitewide projects, or within a subdirectory labeled with its project area (e.g. Lime Basins). All drawings must include a file path in the lower left corner. This will reference any resulting figure to the .dwg file that created it. Include the date of any imagery used as a background in the legend. The drawing file may contain links external references and blocks existing in other CAD files, or to tables of points or other imagery used to make the figure. If source files are renamed or moved to a different subfolder than the one from which the link was generated, the link to this external data will be lost and will no longer be displayed on the figure. To avoid this problem, all externally referenced data sources should be located in the appropriate

subfolder (Images, Tables, Shapes, Drawings, etc). Each drawing or figure should contain a legend which provides, at a minimum, the following information:

1. Names of active source files used in the map (if it is not appropriate to record this information on the legend, include a word document in the Drawings subfolder listing active source files)
2. North arrow and map scale, including units
3. Definition of symbols used on the figure
4. Company logo and client logo (if available)
5. Map author and creation date
6. Map reviewer and approval date

3.6 NON-VECTOR DATA

Image data should be provided in TIFF file format (*.tif, *.tfw). A worldfile that provides spatial reference information (*.tfw) should accompany each TIFF file (*.tif). Digital elevation models or other grid-based data should be provided in ESRI ArcInfo GRID file format, which is stored in a named directory and always accompanied by an INFO directory at the same level in the directory structure.

3.7 METADATA

Each spatial data source and GIS map **must** be accompanied by a metadata XML file that describes its content and all files must use the FGDC CSDGM Metadata template found in attachment A. The metadata file can be created or edited by choosing the data source name listed in the table of contents in ArcCatalog then selecting the *description* tab. For CAD drawings, metadata should be recorded in a word document stored in the same folder as the .DWG file. In general, the same information should be recorded for both GIS maps and CAD drawings.
Edit metadata files to include a short summary, the name of the map creator, a data description, its source, and any limitations on use. The metadata should indicate if any symbols or map elements were used that are not found in the PWT map style and if a PWT-approved map template did not serve as the basis for the map. A CAD MetaData Entry form is included as Attachment B.

4.0 SPATIAL DATA MANAGEMENT AT PROJECT COMPLETION

Most projects involve sequential completion of deliverables which may include preparation of maps, figures and drawings as components to a report or plan. In most cases these figures will be saved and transmitted to the client as PDF files. Transmission of files in PDF format eliminates the need for the client to have the appropriate software and software version to read the document. When creating PDF files in ARGIS it is important to check the "embed all document fonts" box under the Format tab in the export function. Otherwise these fonts will not show up on the client's version of the map if they do not have those fonts on their computer. If the project manager has created folders for draft, draft-final and final versions of the document, it is advisable to locate the PDF files used

for that document in the same folder so that re-issue of the document at a later date can be performed easily.

4.1 SUBMITTAL OF FINAL SPATIAL DATA FILES TO EPA

At contract closeout, or completion of a project (or stage of a project if it is a large project), EPA Region 8 has stipulated how spatial data files are to be submitted. Final versions of GIS files will be submitted in the format stipulated in NGDP guidance in Attachment A. The accepted projection for GIS deliverables is decimal degrees with the minimum information that needs to be provided as follows:

ID – a unique identifier given to each feature
Latitude – the Y coordinate in decimal degrees, 6 significant digits
Longitude – the X coordinate in decimal degrees, 6 significant digits
Horizontal Datum – the datum of the coordinates.

This will necessitate conversion of GIS files from the projected coordinate system used on the project to the geographic coordinate system identified above. All CAD and image file data must also be delivered in known real world coordinate space (typically as identified above) and not in paper space or in a custom site specific projection. The NGDP guidance stipulates that final maps or drawings submitted in PDF format have at least 300 dot-per-inch resolution.
EPA contracts typically stipulate the time duration that PWT must maintain data and deliverables for projects. The project manager should insure that project data is archived and maintained for the period specified in the contract.

ATTACHMENT A

U.S. EPA Region 8
GIS Deliverable Guidance

Region 8 Ecosystems Protection and Remediation

Program Support

Data Systems Team

GIS

Version 1.0 January 6, 2014

Document Revision	Author	Version	Description
1/6/14	John Wieber	1.0	Final

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Contents

Purpose

The purpose of this document is to provide guidance to contractors, grantees, or others who provide GIS deliverables to EPA Region 8 programs, projects, or staff.

Scope

This document covers the types of GIS deliverables anticipated in Region 8 and how the Region would like to receive these deliverables. Additionally, data standards, formats, and best management practices are identified.

Responsibilities

The Region 8 GIS team is responsible for maintaining this document and providing it to those parties wishing to provide Region 8 with spatial data or products. It is the responsibility of those providing deliverables to the Region to adhere to the guidance provided in this document to the best of their abilities. The Region 8 GIS team relies on other EPA staff such as grant/contracting officers, RPMs, and inspectors to ensure data are getting submitted for long-term use at EPA.

Introduction

This document is intended to specify GIS file delivery formats for all geospatial materials developed in support of GIS related work within EPA Region 8. It is the intent of EPA Region 8 to acquire, catalog and manage all GIS files comprehensively across all projects to:

1) ensure future use and access to EPA,
2) provide an archive of work accomplished,
3) maintain and serve data that spatially represent features pertinent to on-going EPA efforts, and
4) provide a basis for future activities such as CERCLA Five Year Review.

GIS Formatted Data Files

All final version spatially enabled files acquired or developed to support mapping and/or spatial analysis by a contractor or grantee are considered property of the EPA and are required to be submitted to EPA. Delivery schedules are negotiable, but should be annual at a minimum. This includes but is not limited to all GIS, CAD, and image formatted files used to develop maps for any scoping or decision document developed for EPA, as well as any spatial file used to inform a decision on site management or development. Only final versions of each layer are required for delivery to EPA, and must be in an approved format as specified in this document. In addition, all electronic geospatial data, whether vector or raster, must be projection defined (have a projection defined and embedded in or associated with the data file), and in the case of CAD data must NOT be in page space or a custom site-specific projection. All CAD data must be in known real world coordinate space, ideally conforming to the projection specifications outlined below. Should tabular data be appropriate to connect location information with attribute information, then documentation specifying the primary and foreign keys is required. Should coordinate information be provided in tabular format it should contain at minimum the following fields:

ID – a unique identifier given to each feature
Latitude – the Y coordinate in decimal degrees, 6 significant digits
Longitude – the X coordinate in decimal degrees, 6 significant digits
Horizontal Datum – the datum of the coordinates.

Additionally all static maps that appear in an EPA document should be in an electronic Adobe PDF format with fonts embedded and at a resolution of 300 dots per inch (dpi) or greater. Finally, any dynamic maps used in final map production, such as ESRI ArcMap documents (.mxd), may also required for delivery to EPA with accompanying data in a stand-alone directory structure. Such documents are recommended to be provided as ESRI map packages (.mpk).

Projection Requirements

All GIS files submitted to EPA must have spatial reference information that describes the projection, datum, and where applicable the collection methods. The EPA requests that all vector data be submitted in geographic coordinate system, decimal degree units, and NAD83 datum, as is required under the EPA National Geospatial Data Policy, 2008. Raster data, such as aerial photographs may be submitted in their native projection, and maps should be in the appropriate projection/coordinate system for the area depicted. EPA Region 8 GIS staff will be happy to consult and advise on projection, coordinate, and datum details for submission to EPA.

Metadata Requirements

All GIS files developed for EPA are required by Executive Order 12906 to have associated metadata. EPA requires FGDC compliant metadata on all GIS files developed for site support. Region 8 also requires that all dynamic maps (ArcMap documents) have metadata completed. The Content Standard for Digital Geospatial Metadata can be found at www.fgdc.gov. Metadata, including information about the data's projection, can be developed using one of several built-in or add on tools within a GIS, and typically is associated with the geometry file as an XML file. EPA Region 8 GIS staff will be happy to consult and advise on development of required metadata.

Organizational Requirements

If the project is complex, a directory structure and readme text file in the upper level directory that describes the structure is required. Because EPA will be managing data across many projects, it is important to make your submittals as understandable as possible. A recommended directory structure is as follows:

<**Project_Name**>
- |_ **Docs** (reports, SOPs, correspondence, and other such documents)
- |_ **Images** (aerial photos, satellite imagery, logos, DEMs, and other raster type data)
- |_ **Maps** (MXDs and PDFs. Map names should use the project name as a prefix)
- |_ **Shapes** (geodatabases, shape files, and other approved vector data formats)
- |_ **Source** (original unmodified data that may have been acquired from external/internal sources)
- |_ **Tables** (MS-Access databases, spreadsheets, delimited text files, or other such tabular data not stored in a geodatabase)

File naming conventions should be logical, consistent, and contain no spaces or special characters. An underscore may be used in lieu of a space.

Delivery Requirements

EPA will accept data delivered on CD-Rom, DVD, or external hard drive, as well as direct electronic submission via email or FTP site. Other delivery methods may be allowed if those requirements present a significant burden or as technology changes.

EPA Acceptable Data Formats

The following file formats are considered acceptable and all maps and data must include an associated metadata document:

DATA
Vector **projected to geographic, decimal degrees, NAD83**
File Geodatabase (.gdb) *Preferred Shape File (.shp, .shx, .dbf, .prj, .sbx, .sbn) Personal Geodatabase (.mdb) ESRI Map Package (.mpk)
Raster **native projection acceptable**
TIFF image with world reference file or as a GeoTIFF (.tif, .tfw) JPEG image with world reference file (.jpg, .jpw) ERDAS Imagine image with pyramid file (.img, .rrd) MrSid image (.sid) ESRI Grid DEM
TINs **appropriate projection/coordinate system for the area depicted**
ESRI TIN
CAD **projected to geographic, decimal degrees, NAD83**
DXF layer separates (.dxf)
Tabular **primary keys should be clearly identified/documented**
MS-Access database (.mdb) MS-Excel spreadsheet (.xls) Delimited text file (.txt,
MAPS
Static
Adobe PDF at 300 dpi or better with embedded fonts (.pdf)
Dynamic
ESRI Map Package (.mpk)

FGDC Compliant METADATA
XML (.xml)

CHECKLIST

The following checklist may be used to assist in complying with these standards:

DATA

- ☐ Is each vector file, CAD included, in geographic, decimal degrees, NAD83?
- ☐ Is each raster file in its native projection?
- ☐ Is each data file one of the EPA acceptable formats?
- ☐ Does each data file have FGDC compliant metadata in an associated file?
- ☐ Are the primary and foreign keys documented for tabular data?
- ☐ Is a README text file included with a directory structure explaining how the structure is organized?

MAPS

- ☐ Is each static map provided in an electronic format at a resolution of 300 dpi or higher?
- ☐ Does each static map have fonts embedded?
- ☐ Has the page and print setup for map documents been configured to NOT use printer-specific paper settings?
- ☐ Are map documents set to use relative paths?
- ☐ Are map names prefixed with the project name?
- ☐ Are map documents accompanied with their relevant data in a stand-alone directory structure?
- ☐ Does each map have FGDC compliant metadata in an associated file?

ATTACHMENT B

Meta Data Entry Form

Spatial Metadata

REQUIRED INFORMATION:

Data Source (organization):

Contact (Person, Organization, Telephone, E-mail, and Address):

Citation Information (Title, Originator, Publication Date):

File type or format:

Spatial Reference (map projection and units):

Abstract (a brief narrative summary of the dataset):

Purpose (a summary of the intentions with which the data set was developed):

Use Constraints (restrictions and legal pre-requisites for using the data set after access is granted):

PWT STANDARD OPERATING PROCEDURE

APPROVED: _____ September 27, 2013
PWT Project Manager, Greg Hayes Date

TABLE OF CONTENTS

List of Attachments

REVISION LOG		
Revision Number	**Description**	**Date**
1.0	Original SOP	July 2011
2.0	QA Review and Update	March 2012

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**
2.0	Annual QA Review	August 2013

1.0 PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used to handle environmental samples (such as: soil, groundwater, surface water, sediment, waste, and air samples) during environmental investigations. This SOP serves as a supplement to site-wide and investigation area specific workplans and the site-specific Quality Assurance Project Plan (QAPP) and may be used in conjunction with other SOPs.

2.0 REQUIREMENTS

The following sections identify the requirements for Quality Assurance / Quality Control (QA/QC), health and safety, and personnel qualifications for sample handling.

2.1. Quality Assurance / Quality Control

Follow all QA/QC requirements identified for the project as identified in approved project planning document(s).

2.2. Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan, Job Safety Analyses (JSAs), any applicable Task-Specific Health and Safety Plans prepared by PWT Subcontractors, and the associated Activity Hazard Analyses (AHAs).

2.3. Personnel Qualifications

Personnel performing sample handling activities will have knowledge and experience in the equipment and procedures used, or will work under the direct field supervision of knowledgeable and experienced personnel. Sample handling will be directed by a PWT field sample manager responsible for ensuring proper handling and shipment of samples. The field sample manager will be knowledgeable and experienced in handling and shipping of environmental samples.

3.0 MATERIALS AND EQUIPMENT

The following materials and equipment may be needed for sample handling, packaging, and shipping:

- Monitoring equipment and personal protective equipment (PPE) as specified in the HASP.
- Appropriate clean sample containers as specified for each analytical method being tested. Sample containers will contain appropriate preservatives, according to method specifications. Sample containers will be provided by the analytical laboratory, unless otherwise specified in the QAPP.
- Decontamination equipment and supplies (e.g., wash/rinse tubs, brushes, Alconox, plastic sheeting, paper towels, sponges, baby wipes, garden-type water sprayers, large plastic bags, potable water, distilled water and/or deionized water).
- Sample handling supplies (e.g., recloseable plastic bags, waterproof markers and sample labels, cooler for sample storage, ice or ice substitute).
- Sample management supplies (e.g., soil sample field data sheets, chain-of-custody [COC] forms). An example COC form is included as Attachment A.
- Sample shipping supplies (shipping coolers, recloseable plastic bags, shipping labels, shipping forms [provided by shipping courier], bubble wrap, tape [e.g., clear tape, packing tape, and custody seal tape]).

Other materials and equipment may be needed based on field conditions.

4.0 PROCEDURES

4.1 Sample Identification

Samples collected during investigation activities will be identified using a pre-determined sample identification (ID) scheme described in the project or investigation –specific sampling plan.

Typically, sample ID numbers consist of two main components:

- The investigation location site identifier, which may include numbers, letters, or a combination of the two, and which corresponds to the investigation location at which the sample was collected
- Sample-specific information, such as the sample collection method, sample depth interval, sample type and sequential sample number

4.2 Sample Labeling

Sample labels will be filled out to the extent possible before field sampling activities begin. However, the date, time, sample depth, and sampler's initials or signature will typically not be completed until the time of sample collection. Sample labels will be filled out using waterproof ink. At a minimum, each label will contain the following information:

- Company's name
- Project name/site location
- Sample ID
- Date and time of sample collection
- Method of preservation (if any) used
- Analyses required
- Sample matrix (e.g., soil, water)
- Sampler initials

4.3 Sample Handling

This section discusses proper sample containers, preservatives, and handling and shipping procedures.

4.3.1 Sample Containers

Unless otherwise specified in the QAPP, clean sample containers will be obtained from the subcontracted analytical laboratory performing the analyses. Extra containers will be ordered to account for the possibility of breakage during shipment or sample collection. To the extent possible, required preservatives will be prepared and placed in the bottles at the laboratory before shipment to the site. Project-specific sample containers will be identified in the site-specific QAPP.

4.3.2 Sample Preservation

Samples will be preserved in accordance with the site-specific QAPP. Chemical preservatives, if necessary, will be added to the sample containers by the laboratory (or vendor) before shipment to the field. Samples will be stored at appropriate temperatures as specified in the site-specific QAPP.

4.3.3 Sample Handling and Shipping

Sample containers will be packaged properly to prevent breakage of containers and leakage of contents. The following procedures will be followed during the packaging and shipping process:

1. Place sample containers in recloseable plastic bags.
2. If sample container is glass, wrap individual sample containers with bubble wrap.
3. Place sufficient amounts of bubble wrap in the bottom and sides of the shipping cooler to prevent movement of contents.
4. Add enough ice (in double bags) or ice substitute to the cooler to maintain proper preservation temperature in accordance with the QAPP.
5. Line the inside of the cooler with a plastic trash bag, place the samples and additional ice as necessary inside, and tie the bag shut.
6. Fill any void space in the cooler with packing material (e.g., bubble wrap) to prevent movement of sample containers.
7. Place the original COC form inside a recloseable plastic bag, and tape the bag to the inside of the cooler lid.
8. Close the cooler lid, and seal the cooler and the cooler drain spout with appropriate packaging tape.
9. Place two custody seals (tampering seals) on the cooler in separate areas over (across) the seal between the lid and the cooler base. Example custody seals are included as Attachment B.

A shipping bill should be completed for the shipper and taped to the top of the cooler using the envelope provided by the shipper. The following markings may also be placed on the top of the cooler:

- This end up
- Fragile
- Laboratory delivery address
- Sender's return address

A copy of the shipping bill will be retained by the field sample manager for attachment to the corresponding COC form. Samples will be hand delivered or shipped by express courier for delivery to the analytical laboratory.

The field sample manager or field team leader is responsible for verifying that samples collected by the field team(s) have been properly identified, preserved, and packaged, and for verifying the accuracy and completeness of sample labels, COC forms, and applicable sample field data sheets and logbook entries.

The following is a summary of steps to be performed by the field sample manager:

- Verify sample labels.
- Verify samples were collected and preserved in accordance with the site-specific FSP and QAPP.
- Check or complete the COC form, photocopy, and retain a copy for the project files.
- Pack samples in shipping containers and verify labels and shipping forms meet shipping requirements.
- Send original COC form to the laboratory.
- Retain a copy of the shipping bill and staple it to the corresponding COC copy.
- Send copies of sample field data sheets and photocopied pages of field logbooks to the project manager.

Close coordination will be maintained between the field sample manager and the analytical laboratory during sample collection and shipment. The laboratory will be instructed to report any handling or preservation issues immediately to the field sample manager (or other designated person) so that corrections can be made to field procedures, if necessary.

4.3.4 Sample Container Tampering

If, at any time after samples have been secured, custody seals on the cooler are identified as having been tampered with, the following procedures will be conducted to ensure that sample integrity has not been compromised:

- Check with personnel having access to sample coolers to assess the possibility of inadvertent breakage of custody seals.
- Inspect sample containers for signs of tampering, such as loose lids, foreign objects in containers, or broken or leaking containers.
- Review sample packaging and handling procedures.
- Document findings of the incident in the sample management logbook.

If it is determined that intentional tampering of samples has occurred, or it is believed that sample integrity has been compromised in any way, the Quality Assurance Officer and appropriate project managers will be notified.

4.3.5 Holding Times and Analyses

Samples will be shipped to the analytical laboratory for analysis as soon as practical following collection. At a minimum, samples will be shipped daily with the following exception. For small projects, samples may be collected over a period of several days at the discretion of the project managers, and then collectively shipped. No samples will be shipped on Friday for weekend delivery unless receipt and analysis procedures are pre-coordinated with the analytical laboratory. Allowable holding times for specific samples will be specified in the site-specific QAPP.

5.0 DOCUMENTATION

Documentation of sample handling is critical to project defensibility. The field sample manager will be responsible for ensuring all sample collection and handling documentation is complete and accurate.

5.1 Sample Management Logbook

The field sample manager will maintain a complete and accurate sample management logbook documenting sample handling procedures and observations. The logbook will be a permanently bound weatherproof field logbook with consecutively numbered pages. The field sample manager will also maintain a complete and accurate sample management file containing copies of all sample field data sheets, sampling crew logbooks, COC forms, shipping documentation, and written logs of correspondence or communications with the laboratory and other pertinent correspondence and communications. The sample management logbook will contain sufficiently detailed information to allow all significant sampling issues to be reconstructed without relying on the memory of sampling personnel.

The sample management logbook will contain daily entries for the following information:

- Project name

- Sampling activities performed that day
- Sampling crews and affiliations
- Sample location identifications
- List of samples collected, including sample IDs, collection time/date, media, analysis methods, and associated COC and shipping documentation
- QA/QC samples collected and submitted for analysis
- Field observations
- Instrument calibration information
- Correspondence and communications
- Field sample manager's signature

Changes or deletions in the logbook will be lined out with a single strike mark, initialed and dated by the person making the change. Sufficient information should be recorded to allow the reason for the change to be reconstructed without relying on the memory of field personnel.

At the end of each day, the field sample manager will prepare copies of the sample management logbook, sample field data sheets, and field crew logbooks for the project manager. The field sample manager will coordinate with the project manager on the required frequency of transmittal of this information to the client. The client will expect this information to be available, accurate, and complete on a daily basis for possible inspection by the client, quality assurance personnel, the project manager or the regulatory agency.

5.2 Chain of Custody

Written documentation of the proper and secure handling of samples from the time samples are collected until laboratory data are issued is critical to project defensibility. The chain of custody of the physical sample and its corresponding documentation will be maintained throughout the handling of the sample. Sample custody applies to both the field and laboratory operations. Information on the custody, transfer, handling, and shipping of samples will be recorded on a COC form. An example COC form is provided as Attachment A. The COC form may consist of a triplicate, pressure-sensitive form or other form prepared by the contract laboratory, or the COC form may be electronically generated in the SCRIBE software. The COC form may vary depending on investigation activities. The investigation contractor will select an appropriate COC form subject to approval by the client.

A sample is under custody if it is in:

- The possession of the sampler/analyst.
- The view, after being in the possession, of the sampler/analyst.
- A sealed shipping container being carried by a designated commercial carrier.
- A designated secure area.

The sampling team will be responsible for initiating the original COC form and will sign and date the COC form when relinquishing sample custody to another person (e.g., the field sample manager) or to the analytical laboratory. The COC form and sample labels will be checked by the field sample manager to verify that samples are accounted for and in good condition, and that no errors were made.

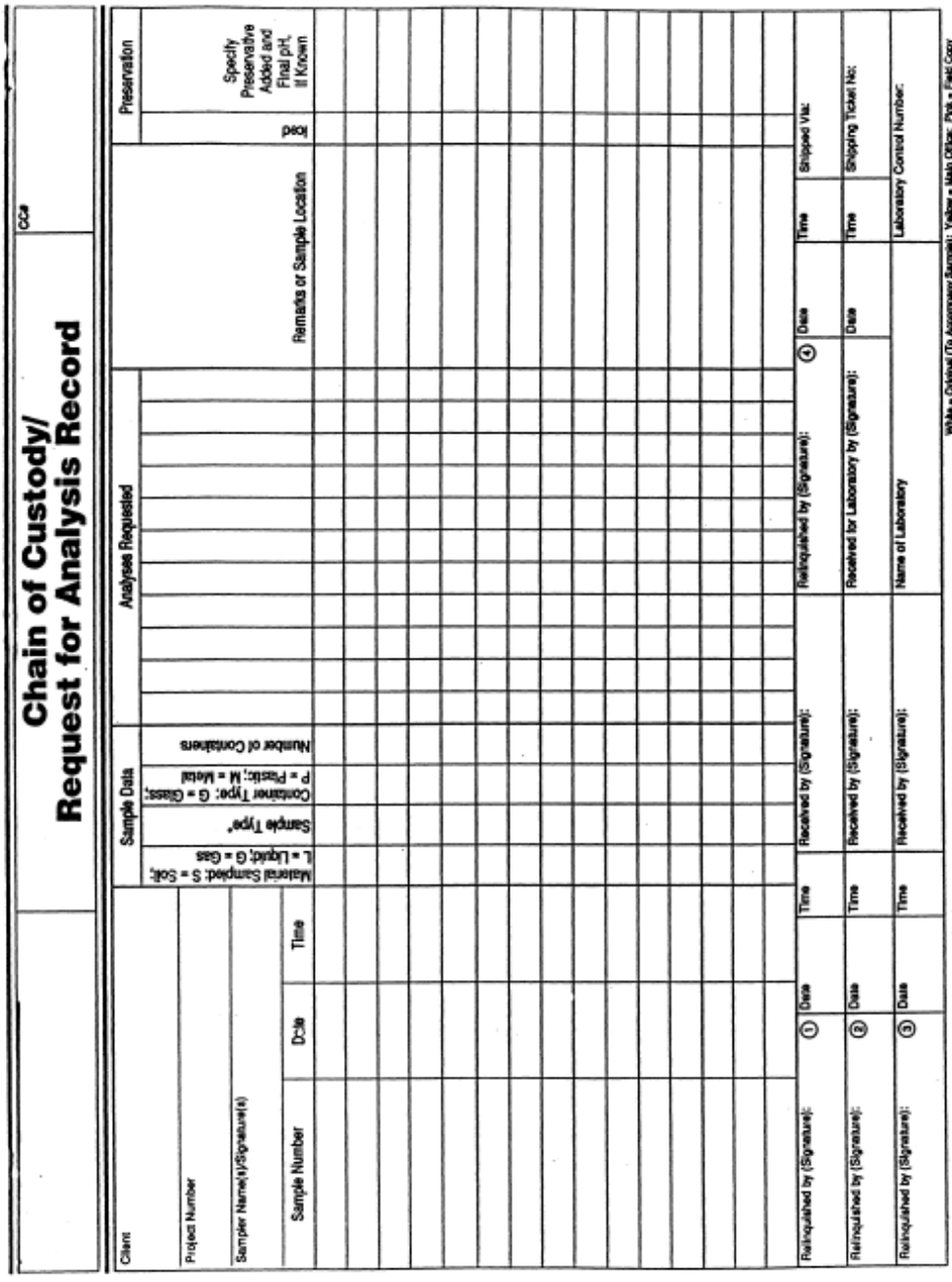
The COC form will include the following information:

- COC number (unique, sequential number on the upper right corner of the form)
- Project name and number
- Sample ID number
- Sample preservatives
- Number of containers
- Sample collection date and time
- Sample matrix
- Requested analyses
- Signature and date blocks for personnel relinquishing or receiving sample custody
- Name and phone number of contractor contact person

Transfer of samples to the analytical laboratory may be via commercial carrier. The field sample manager will verify the proper packaging and shipment of samples. Prior to shipping, the field sample manager will officially transfer sample custody to the commercial carrier or analytical laboratory and secure the COC form inside the shipping container. Shipping containers transferred via commercial carrier will be sealed with strapping tape and with two custody seals. An example custody seal format is provided as Attachment B. Receipts of bills of lading from the carrier will be maintained as part of the custody record. Commercial carriers are not required to sign the COC form as long as the COC form is sealed inside the shipping container and the custody seals remain intact.

Upon receipt at the laboratory, the person receiving the samples will sign the COC form accepting transfer of custody to the laboratory. The laboratory will return a copy of the signed COC form to the designated investigation contractor personnel (i.e., project chemist, field sample manager, or project manager), and will retain a copy on file at the laboratory. The original COC form will remain with the samples until final disposition of the samples by the laboratory in accordance with the site-specific QAPP. After sample disposal, a copy of the original COC will be sent by the analytical laboratory to the investigation contractor.

ATTACHMENT A
EXAMPLE CHAIN OF CUSTODY FORM



Chain of Custody/
Request for Analysis Record

COC#

Client

Project Number

Sampler Name(s)/Signature(s)

Sample Number | Date | Time

Sample Data

Material Sampled: S = Soil; L = Liquid; G = Gas

Sample Type*

Container Type: G = Glass; P = Plastic; M = Metal

Number of Containers

Analyses Requested

Remarks or Sample Location

Preservation

Iced

Specify Preservative Added and Final pH, If Known

Relinquished by (Signature): ① Date Time | Received by (Signature): | Relinquished by (Signature): ④ Date Time | Shipped Via:

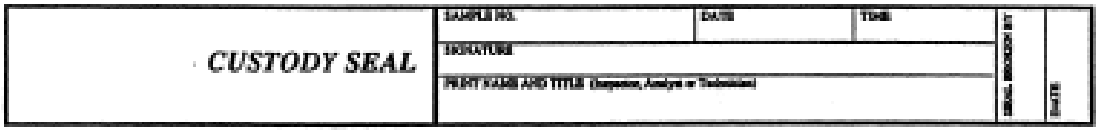
Relinquished by (Signature): ② Date Time | Received by (Signature): | Received for Laboratory by (Signature): Date Time | Shipping Ticket No:

Relinquished by (Signature): ③ Date Time | Received by (Signature): | Name of Laboratory | Laboratory Control Number:

*G = Grab; C = Composite; S = Split Spoon; ST = Shelby Tube; O = Other

White = Original (To Accompany Sample); Yellow = Main Office; Pink = Field Copy

ATTACHMENT B
EXAMPLE CUSTODY SEAL



Custody Seal

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REVISION LOG		
Revision Number	**Description**	**Date**
0.0	Original SOP	July 2011
1.0	QA Review and Update	March 2012

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**
2.0	Annual QA Review	August 2013

1.0 PURPOSE

This Standard Operating Procedure (SOP) provides technical guidance and procedures for utility clearances at project sites. This SOP serves as a supplement to site-wide and investigation area specific workplans and the site-specific Quality Assurance Project Plan (QAPP) and may be used in conjunction with other SOPs.

2.0 REQUIREMENTS

2.1 Quality Assurance / Quality Control

Follow all QA/QC requirements identified for the project as identified in the approved project planning document(s).

2.2 Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan (HASP), Job Safety Analyses (JSAs), any applicable Task-Specific HASPs prepared by PWT Subcontractors, and the associated Activity Hazard Analyses (AHAs).

3.0 RESPONSIBLE PERSONNEL

The project manager has the overall responsibility for implementing this SOP. The project manager will be responsible for assigning staff to implement this SOP and for ensuring that the procedures are followed by all personnel. The field team leader is responsible for ensuring that the appropriate utility clearances have been performed prior to any intrusive field activities. All utility clearances will comply with applicable portions of the Site-Specific HASP.

4.0 PROCEDURES

Locations selected for intrusive field activities (e.g. borehole drilling, trenching) will be cleared of utilities before field activities begin. Utilities may be located below ground or above ground. Before intrusive field activities can be performed each location will be cleared for the following utilities; natural gas, telecommunications, water and sewer, electrical, fiber optics and cable. At some locations additional utilities that may require clearance include petroleum service lines, irrigation lines, and building foundations. Locations selected for intrusive work must be visually cleared for overhead utilities by the project manager or designee. This overhead utility check shall be recorded in the field logbook. Location of underground utilities will require additional steps, as described below.

It is the responsibility of the project manager to contact utility organizations directly for utility clearance at least one week in advance of scheduled intrusive work. Some utility companies guarantee that they will be present at the scheduled meet time. Other utility companies may call to reschedule at a different time or day or reschedule the day of the scheduled utility meet. If possible the utility clearance should be done a few days prior to intrusive work to allow enough time for utilities companies to clear their lines. The utility companies will identify their utilities with spray paint on the ground. They also may leave a map or sketch at the location with their lines identified. In addition to the project manager (or designee), each subcontractor performing the actual intrusive work is required to attend the utility clearance, to pose

any necessary questions. The subcontractors should request the same meet time that the PWT project manager has set up. A representative from each of the subcontractors is required to be present at the utility meet.

5.0 DOCUMENTATION

Underground and overhead utility clearance activities will be documented in the field logbook by the project manager, field team leader or rig geologist. The documentation will include the utility locator service sign-off, personnel present for the locate, the final project-site representative approval (if requested), and any current and historical maps used in locating utilities (or references to locations of maps for future reference).

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REVISION LOG		
Revision Number	Description	Date
0.0	Original SOP	July 2011
1.0	QA Review and Update	May 2012

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**
2.0	Annual QA Review	August 2013

1.0 PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used to log boreholes drilled in unconsolidated and weathered bedrock during environmental investigations. This SOP serves as a supplement to site-wide and investigation area specific work plans and the site-specific Quality Assurance Project Plan (QAPP) and is intended to be used in conjunction with other SOPs.

2.0 REQUIREMENTS

The following sections identify the requirements for Quality Assurance / Quality Control (QA/QC), health and safety, and personnel qualifications for borehole logging.

2.1. Quality Assurance / Quality Control

Follow all QA/QC requirements identified for the project as identified in the site-specific planning documents (QAPP, Work Plan, etc).

2.2. Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan (HASP), Job Safety Analyses (JSAs), any applicable Task-Specific Health and Safety Plans prepared by PWT Subcontractors, and the associated Activity Hazard Analyses (AHAs).

2.3. Personnel Qualifications

Personnel performing borehole logging are required to have completed the initial 40-hour OSHA classroom training that meets the Department of Labor requirements 29 CFR 1910.120(e)(3)(i), and must maintain a current training status by completing the appropriate annual 8-hour OSHA refresher courses. Personnel must also have read and signed the appropriate HASP(s). Prior to engaging in borehole logging activities, personnel must have a complete understanding of the procedures described within this SOP and, if necessary, will be given specific training regarding these procedures by other personnel experienced in the methods described within this SOP.

Personnel responsible for logging boreholes in unconsolidated and consolidated geologic material will be appropriately trained individuals with a minimum of a bachelor's degree in geology or a related field and have applicable field experience. Other qualified personnel may include geotechnical engineers or field technicians with an appropriate amount of applicable field experience or on-the-job training under the supervision of another qualified person.

3.0 MATERIALS AND EQUIPMENT

The following materials and equipment may be needed for borehole logging:

- Boring log form (Attachment A)
- Bound field notebook
- Waterproof pens
- Hand lens (10x magnification or higher)
- Latex or nitrile gloves and other required PPE
- Tape measure
- Stainless steel knife, screwdriver, rock hammer
- Decontamination equipment and supplies (e.g., wash/rinse tubs, brushes, Alconox, plastic sheeting, paper towels, sponges, baby wipes, garden-type water sprayers, large plastic bags, potable water, distilled water and/or deionized water)
- Electronic water level meter
- Appropriate field monitoring instruments (e.g., photoionization detector [PID], flame ionization detector [FID], combustible gas indicator [CGI]), as required by the HASP
- Reference tables listing ASTM and/or USCS codes and descriptions
- Munsel color chart

Other materials and equipment may be needed based on field conditions.

4.0 PROCEDURES

4.1 BORING LOG

The boring log is the primary record of observations of physical conditions encountered during borehole drilling. The primary purpose of the boring log is to document all pertinent information that may be necessary for someone other than the rig geologist to understand and interpret the geologic and hydrogeologic conditions observed during drilling. For example, at some sites, a critical issue is the contact between the unconsolidated material and the weathered bedrock, which may be readily apparent based on textural or color indications, or may be difficult to discern, requiring determination based on mineralogical properties. The boring log must provide sufficient textural, color, and mineralogical information so that someone other than the rig geologist can understand the basis for identification of those items, conditions or locations which are critical to the specific investigation or project.

Each borehole will be drilled and sampled in accordance with an appropriate drilling and sampling SOP. The rig geologist will be responsible for preparing detailed, complete, and accurate boring logs in the field using the boring log form (Attachment A) as drilling progresses. The preparation of legible and complete boring logs during drilling is necessary so that the borehole and geologic conditions are properly documented.

At a minimum, the following information will be documented on the boring log:

- Project name / Investigation name
- Supervising contractor name
- Boring identification number
- Start date and time
- End date and time

- Rig geologist name
- Drilling subcontractor and personnel
- Drill rig type
- Drilling method
- Bit diameter (and borehole diameter, if different)
- Auger external and internal diameter
- Sampling method
- Total depth of borehole recorded to the nearest 0.1 feet
- Ground surface elevation (recorded on log following surveying)
- Surveyed horizontal coordinates (recorded on log following surveying). If surveyed horizontal coordinates are not available at the time of drilling, location sketches referencing measured distances to prominent surface features (e.g., building corners, existing wells, fence corners) shall be recorded in the geologist's field log book.
- Sample depths or intervals recorded to the nearest 0.1 feet
- Blow counts
- Sample recovery
- USCS, ASTM or USDA classification for unconsolidated materials
- Rock type classification for consolidated materials
- Graphic representation of material
- Detailed lithologic description. For unconsolidated materials the description should address the parameters listed in Table 1, including compaction/consistency, water content, color, texture (grain sizes, sorting, and shapes) and plasticity, major and minor constituents (e.g., gravel, sand silt, clay), and major mineralogy (as identifiable from the sample). For rock materials the description should address the parameters listed in Table 2, including weathering classification, color, texture, hardness, rock type and major mineralogy, and presence and orientation of fractures, staining, and bedding.
- Stratigraphic/lithologic changes. Where distinct lithologic changes are directly observed, they will be identified on the boring log by a solid horizontal line. Gradational transitions and changes identified indirectly from cuttings or methods other than direct observation and measurement will be identified by a horizontal dashed line.
- Detailed description of basis for identification of top of weathered bedrock and top of unweathered bedrock.
- Depth at which water is first encountered, the depth of water at the completion of drilling, and the static depth to water (if possible). Static water level data will include time allowed for levels to stabilize. The absence of water in borings will also be indicated.
- Borehole field meter readings (e.g., PID, FID, CGI, radioactivity meter)
- Other drilling, sampling, and borehole observations as appropriate (e.g., resistant layers, typical or unusual odors, staining, or other indications of potential contamination)

4.2 FIELD LOGBOOK

In addition to the boring log, the geologist will also maintain a bound field logbook. The purpose of the field logbook is to document a semi-narrative record of the field conditions, activities, and events

relevant to the field program on a daily basis. The field logbook constitutes the daily written record of the field activities, while the boring log constitutes the written record of the borehole conditions. The following information shall be recorded daily in the bound field logbook if approved field forms are not used:

- Arrival time at site
- Names and affiliations of personnel working at the drilling location
- Equipment used at the drilling location (drill rig, field screening equipment)
- Names of visitors to the drilling location
- Health and safety and field procedure briefings and attendees
- Weather conditions
- Chronological record of drilling and sampling activities documenting times and drilling subcontractor rates and material quantities
- Significant events, such as equipment breakdown, health and safety problems, drill crew standby
- Location and sample station number (including sketches showing measurements from prominent surface features (e.g., building corners, existing wells, fence corners)
- Sample documentation, disposition, and cross references to sampling forms and chain-of-custody records
- Decontamination activities
- Investigation Derived Waste handling activities
- Field screening instrument calibration information and measurements
- Other health and safety observations or concerns
- Significant deviations from the QAPP or SOPs
- Other applicable information
- Departure time from site

TABLE 1

LOG DESCRIPTORS FOR UNCONSOLIDATED SOIL

Parameter	Example
Depositional environment and formation, (if named and if known).	Alluvium; Piney Creek
Unified Soil Classification System and designation.	Clayey sand (SC), sandy clay (CL)
Secondary components and estimated quantities either by percentages or by descriptive percentage ranges (note: terms used to indicate ranges should be described on the log or in a general legend).	Sand: fine, with trace of med. trace gravel
Color. May use Munsel color chart.	Gray, brown, yellowish, 5YR 3/2, 5YR 4/4
Consistency (cohesive soil). Use relative term.	Very soft, soft, medium, stiff, very stiff, hard
Density (non-cohesive soil). Use relative term.	Loose, medium, dense, very dense
Moisture content. Use relative term. Do not express as a percentage unless a value has been measured.	Dry, damp, moist, wet, saturated
Texture/fabric/bedding	No apparent bedding, thinly bedded
Grain angularity	Rounded, subangular
Sorting (sands)	Poorly sorted, well graded
Grain or fragment size	Coarse, very fine
Mineralogical indicators	Quartz, feldspar grains
Note "fill", "top of natural ground", "top of weathered bedrock", and “top of unweathered bedrock” where appropriate	

TABLE 2

LOG DESCRIPTORS FOR CONSOLIDATED ROCK

Parameter	Example
Formation name (if known)	Denver Formation; Kootenai Formation
Rock type	Sandstone, shale, siltstone
Modifier denoting variety	Shaly, calcareous, siliceous, argillaceous, sandy, micaceous
Hardness	Very soft, soft, moderately hard, hard, very hard
Color	Medium brown, bluish-gray
Bedding	Parting band, thin bedded, medium bedded, thick bedded, massive, structureless, interbedded (Note: provide thickness range of each in legend)
Texture	Poorly cemented, well cemented, fine, coarse
Degree of weathering	Unweathered, intensely weathered
Degree of fracturing, fracture staining or filling	Highly fractured, limonite staining in fractures, MnO staining, calcite or zeolite fracture filling
Fracture orientation	Inclined 30º, horizontal
Structure and Orientation	Dipping beds at 10º
Mineralogical indicators	Andesite, volcanic grains, mafic minerals
Moisture content	Dry, damp, moist, wet, saturated

ATTACHMENT A

BORHOLE LOG FORM

SOIL BOREHOLE LOG

SITE NAME AND LOCATION:	DRILLING METHOD:	BORING NO.	
		SHEET ____ OF ____	
	SAMPLING METHOD	DRILLING	
		START	FINSH
NORTHING:	COMMENTS	TIME	TIME
EASTING: ELEVATION:		DATE	DATE
DRILL RIG	SURFACE CONDITIONS		
ANGLE BEARING			
SAMPLE HAMMER			

DEPTH IN FEET (ELEVATION)	Blow/ 6 in on sampler	RECOVERY	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

DRILLING CONTRACTOR: _____

LOGGED BY: _____

PROJECT NUMBER: _____

DRILLER NAME: _____

CHECKED BY: _____

PROJECT NAME: _____

PWT STANDARD OPERATING PROCEDURE

INVESTIGATION DERIVED WASTE MANAGEMENT Procedure No. PWT-ENSE-423
Revision 1
Date effective: 03/01/12

APPROVED: _____ September 27, 2013 Page i of 5
PWT Project Manager, Greg Hayes Date

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Attachment A Waste Inventory Tracking Form

Attachment B Maximum Concentration of Contaminants for the Toxicity Characteristic

REVISION LOG		
Revision Number	**Description**	**Date**
0.0	Original SOP No. GW.105	01/23/12
1.0	QA Review and Update	03/01/12

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**
2.0	Annual QA Review	August 2013

1.0 PURPOSE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used for the handling, management, and disposal of investigation derived waste (IDW) encountered or generated during environmental field activities. This SOP serves as a supplement to the investigation area-specific work plans and QAPPs, and is intended to be used with other activity-specific SOPs. IDW management personnel are also referred to *Management of Investigation-Derived Wastes During Site Inspections* (EPA 1991), *Guide to Management of Investigation-Derived Wastes* (EPA 1992) and applicable state and federal requirements.

2.0 REQUIREMENTS

The following sections identify the requirements for Quality Assurance / Quality Control (QA/QC), health and safety, and personnel qualifications for IDW management.

2.1 Quality Assurance / Quality Control

Follow all QA/QC requirements identified for the project as identified in the approved project planning document(s).

2.2 Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan (HASP), Job Safety Analyses (JSAs), any applicable Task-Specific HASPs prepared by PWT Subcontractors, and the associated Activity Hazard Analyses (AHAs).

2.3 Personnel Qualifications

Personnel overseeing the handling and disposal of IDW will have IDW management knowledge and experience, or will work under the direct field supervision of knowledgeable and experienced personnel.

3.0 MATERIALS AND EQUIPMENT

The following materials and equipment may be needed for IDW management:

- Personal protective equipment (PPE) as outlined in the HASP
- Decontamination equipment and supplies (e.g., wash/rinse tubs, brushes, alconox, plastic sheeting, paper towels, sponges, baby wipes, garden-type water sprayers, large plastic bags (minimum 0.85 mil), potable water, distilled water and/or deionized water)
- Department of Transportation (DOT)-rated 55-gallon drums or other approved containers for containing soil cuttings, decontamination water, and formation water
- Drum/bung wrench and drum funnel
- Heavy equipment forklift or vehicle with drum grappler
- Laboratory-supplied sample containers
- Photoionization detector (PID) or flame ionization detector (FID)
- Wood pallets

- Non-porous (e.g., stainless steel) shovels
- Hazardous Waste Labels
- Soil roll-off bins with liners and covers (if warranted)
- Polyethylene tank (if warranted)
- Waterproof and permanent marking pens

4.0 PROCEDURES

Environmental field activities may generate IDW that poses a risk to human health and the environment. It is anticipated that both non-liquid and liquid IDW will be generated or encountered during environmental field activities.

Non-liquid IDW may include:

- Drill cuttings from soil borings
- Sludges (from soil borings in the saturated zone and from development water)
- Excavated soil from trenches
- Construction debris (e.g., concrete and asphalt)
- Buried landfill materials (e.g., burned wood, desks, and metal objects)
- PPE
- Disposable investigation equipment (i.e., bailers, twine, discarded sample bottles, preservative containers, paper towels, aluminum foil)
- Empty drums

Liquid IDW may include:

- Well development water
- Purge water (from monitor wells)
- Well abandonment water
- Decontamination water

4.1 Non Liquid IDW

4.1.1 Soil IDW

- Soil cuttings generated during drilling and soil sampling will be placed into DOT-rated 55-gallon drums, or appropriately sized containers at the point of generation.
- Mixing of the cuttings from several borings or sampling locations is permissible in order to fill the drums. The splitting of cuttings from one boring into several drums should be avoided.
- When drums are full, or daily activities are completed, the drum lids and rings will be fastened. Full drums will be transported to a designated IDW accumulation area on a regular basis to avoid

accumulation of drums at investigation sites for extended periods of time. Alternative temporary IDW accumulation areas can be used as specified in the investigation-specific work plan.

- If large volumes of soil IDW will be generated, soil IDW will be transferred from the drums into roll-off bins (lined and covered) located within the designated IDW accumulation area.
- If only a small volume of soil IDW will be generated, DOT-rated 55-gallon drums can be used for the temporary storage of soil IDW pending analysis. Drums will be stored on pallets at the designated IDW accumulation area. Drums from individual sites will be segregated from each other as much as possible. The drums will be sealed and labeled with permanent markings (using paint pens or drum labels) with the following information:
    1. Source: the boring(s), well, or site identification number
    2. Matrix (e.g., soil, water)
    3. Sample interval (e.g., 0–20 ft or well screen depth) (multiple drums of development or purge water will be numbered consecutively as they are filled)
    4. Fill date
    5. Drum identification number
    6. Contractor
    7. The EPA or PWT designee point of contact with phone number
    8. "Contents Pending Analysis"

Soil IDW in drums will typically be characterized and disposed of based on the characterization of associated investigation sample results (if collected and analyzed).

If no associated investigation sample results exist, a composite soil sample will be collected from the soil IDW drums by collecting a drive or hand auger sample from each of the drums associated with a specific field activity. The sample material from all of the drums will be composited into a single sample that will be used to characterized and dispose of the soil IDW.

4.1.2 Excavated Soil from Trenches

Most trenching operations will generate substantial volumes of excavated soil.

Large volumes of excavated soil IDW will be placed directly into roll-off bins (lined and covered) at the excavation site. This procedure will minimize concerns resulting from stock piling the soil IDW, such as wind dispersion and contamination of the ground surface.

- Small volumes of excavated soil can be placed in drums at the excavation site. Drums will be labeled and stored as described in Section 4.1.1.
- Soil IDW in drums will be sampled (if warranted), characterized, and disposed of as described in Section 4.1.1 above.

Soil IDW placed on the ground surface prior to placement into drums or roll-off bins, must be placed on plastic sheeting covering the ground surface. The soil IDW must be transferred to drums or roll-off bins before completion of the days activities.

4.1.3 Construction Debris and Landfill Material

- Small pieces of construction debris or landfill materials, that do not, and have not, contained controlled substances may be placed in the soil IDW roll-off bins or drums. For example, small amounts of wood, concrete, rebar, and paper do not require segregation from the soil IDW.
- Large volumes of the materials listed above, and large objects, such as desks or large metal objects, will be segregated separately from the soil IDW.
  - If the associated soil IDW is characterized as nonhazardous, these materials can be disposed of as nonhazardous solid waste.
  - If the associated soil IDW is characterized as hazardous, potential surface contamination will be removed from the large objects with nonporous surfaces by brushing off, or using small amounts of water to scrub off, gross potential contamination. After decontamination, these objects can be disposed of as nonhazardous solid waste.
  - If the associated soil IDW is characterized as hazardous, large objects with porous surfaces may require disposal as hazardous waste. Consult the IDW disposal contractor.
- Containers that may contain or potentially contained controlled substances (e.g., paint cans, drums) will be segregated from the materials described above and placed in appropriately sized containers.
  - Consult the IDW disposal contractor for the appropriate disposal requirements for these materials.

4.1.4 PPE and Disposable Investigation Equipment

- PPE and disposable investigation equipment will be segregated separately and placed in dedicated heavy duty (minimum 0.85 mil) plastic bags or containers (e.g., drums).
- Potentially contaminated PPE or disposable investigation equipment will be decontaminated prior to placement in the plastic bags or containers, if warranted.
- Decontamination procedures consist of brushing off, or using small amounts of water to scrub off, gross potential contamination.
- PPE and disposable investigation equipment that have been decontaminated, if warranted, are considered refuse and do not require characterization prior to disposal as nonhazardous solid waste.

4.2 Liquid IDW

- Well development, purge, abandonment, and decontamination water will be contained in DOT-rated drums, or appropriately sized water-tight containers, at the point of generation. When drums are full, or daily activities are completed, the drum lids and rings will be fastened, and the drums will be transported to the designated temporary IDW accumulation area as described in Section 4.2 of Attachment B. Alternative temporary IDW accumulation areas can be used as specified in the activity-specific work plan.
- If large volumes of water will be generated, the water will be transferred into an appropriately sized polyethylene tank. The liquid IDW in the polyethylene tank will be characterized based on the analytical results of the well or wells sampled, or from a representative grab sample collected from the tank. The sample will be collected using a colliwasa, disposable point source bailer, or bomb sampler for discrete interval sampling within the polyethylene tank.

- After analytical data for the liquid IDW are obtained from the laboratory, the data will be directly compared to the hazardous waste concentrations presented in Table 1 in 40 CFR §261.24 (Attachment A). The liquid IDW will then be removed, and treated and disposed of by a certified hazardous waste contractor in accordance with the applicable waste characterization (Section 5.0).
- If only a small volume of water IDW will be generated, DOT-rated 55-gallon drums can be used for the temporary storage of water IDW pending analysis. Water IDW drums will be labeled and stored as described in Section 1.1.1, Soil IDW above.
- Water IDW in drums will be characterized and disposed of based on the characterization of associated investigation sample results (if collected and analyzed).
- If no associated investigation sample results exist, a composite water sample will be collected from each of the water IDW drums associated with a specific field activity. The sample will be used to characterize and dispose of the water IDW.
- The list of chemicals to be analyzed for is the same as the list for soil characterization (Attachment A).

5.0 DOCUMENTATION

Project staff are responsible for thoroughly documenting IDW handling and disposal activities. IDW personnel will be responsible for documenting the collection, transportation, labeling (if applicable), and staging or disposition of IDW. The documentation will be recorded with waterproof ink on a Waste Inventory Tracking Form (Attachment A) or in the sampler's field notebook with consecutively numbered pages. The information entered concerning IDW should include the following:

- Project Name
- PWT and subcontractor personnel
- Site location
- Type of activities
- Date waste generated
- Boring, well, or site number(s)
- Matrix
- Type of container(s) and identification number(s)
- Estimated volume
- Disposition of contents (roll-off/location, tank/location, temporary staging area)
- Waste characterization
- Comments (field evidence of contamination [e.g., PID reading, odors])

ATTACHMENT A

Waste Inventory Tracking Form

WASTE INVENTORY TRACKING FORM

Project Name: _____

PWT and Subcontractor Personnel: _____

Site Location: _____

Type of Activities: _____

Date Waste Generated	Borehole, Well, or Site #	Matrix	Type of Container (Plus ID#, if applicable)	Estimated Volume	Disposition of Contents	Waste Characterization	Comments (Field Evidence of Contamination [e.g., PID reading, odors])

Signature: _____

ATTACHMENT B

Maximum Concentration of Contaminants for the Toxicity Characteristic

Maximum Concentration of Contaminants for the Toxicity Characteristic

EPA Hazardous Waste Number	Contaminant	Regulator Level (mg/L)
D004	Arsenic	5.0
D005	Barium	100.0
D018	Benzene	0.5
D006	Cadmium	1.0
D019	Carbon tetrachloride	0.5
D020	Chlordane	0.03
D021	Chlorobenzene	100.0
D022	Chloroform	6.0
D007	Chromium	5.0
D023	o-Cresol	[(1)] 200.0
D024	m-Cresol	[(1)] 200.0
D025	p-Cresol	[(1)] 200.0
D026	Cresol	[(1)] 200.0
D016	2,4-D	10.0
D027	1,4-Dichlorobenzene	7.5
D028	1,2-Dichloroethane	0.5
D029	1,1-Dichloroethylene	0.7
D030	2,4-Dinitrotoluene	0.13
D012	Endrin	0.02
D031	Heptachlor (and its epoxide)	0.008
D032	Hexachlorobenzene	0.13
D033	Hexachlorobutadiene	0.5
D034	Hexachloroethane	3.0
D008	Lead	5.0
D013	Lindane	0.4
D009	Mercury	0.2
D014	Methoxychlor	10.0
D035	Methyl ethyl ketone	200.0
D036	Nitrobenzene	2.0
D037	Pentachlorophenol	100.0
D038	Pyridine	5.0
D010	Selenium	1.0
D011	Silver	5.0
D039	Tetrachloroethylene	0.7
D015	Toxaphene	0.5
D040	Trichloroethylene	0.5
D041	2,4,5-Trichlorophenol	400.0
D042	2,4,6-Trichlorophenol	2.0
D017	2,4,5-TP (Silvex)	1.0
D043	Vinyl chloride	0.2

Notes:
[(1)]If o-, m-, and p- Cresol concentrations cannot be differentiated, the total cresol (DO26) concentration is used. The regulatory level of total cresol is 200 mg/L.
Source: 40 CFR 261.24 and WHWRR, Chapter 2, Section 3 (e)(ii).

PWT STANDARD OPERATING PROCEDURE

PERSONNEL AND EQUIPMENT DECONTAMINATION Procedure No. PWT-ENSE-424
Revision 2
Date effective: 03/01/12

APPROVED: _____ September 27, 2013 Page i of 4
PWT Project Manager, Greg Hayes Date

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REVISION LOG		
Revision Number	**Description**	**Date**
1.0	Original SOP	July 2011
2.0	QA Review and Update	March 2012

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**
2.0	Annual QA Review	August 2013

1.0 PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used to conduct decontamination of personnel and investigation equipment during environmental investigations. This SOP serves as a supplement to site-wide and investigation area specific workplans and the site-specific Quality Assurance Project Plan (QAPP) and may be used in conjunction with other SOPs.

2.0 REQUIREMENTS

The following sections identify the requirements for Quality Assurance / Quality Control (QA/QC), health and safety, and personnel qualifications for personnel and equipment decontamination.

2.1. Quality Assurance / Quality Control

Follow all QA/QC requirements identified for the project as identified in the approved project planning document(s).

2.2. Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan (HASP), Job Safety Analyses (JSAs), any applicable Task-Specific HASPs prepared by PWT Subcontractors, and the associated Activity Hazard Analyses (AHAs).

2.3. Personnel Qualifications

Personnel overseeing and performing decontamination activities will have knowledge and experience in the equipment and methods proposed, or will work under the direct field supervision of knowledgeable and experienced personnel.

3.0 MATERIALS AND EQUIPMENT

The following materials and equipment may be needed for personnel and equipment decontamination:

- Monitoring equipment and personal protective equipment (PPE) as outlined in the HASP.
- Decontamination equipment and supplies (e.g., wash/rinse tubs, nitrile disposable gloves, brushes, Alconox, plastic sheeting, paper towels, sponges, baby wipes, garden-type water sprayers, large plastic bags, potable water, distilled water and/or deionized water
- High pressure washer/steamer
- Four-foot long capped PVC casing for decontamination of submersible pumps
- Drums or other approved water-tight containers for containing decontamination sediment and fluids
- Materials necessary to construct an investigation site-specific decontamination facility, if required (e.g., heavy plastic sheeting, berming materials, sump pump, water tanks, roll-off bins)

4.0 PROCEDURES

This procedure describes the method for physically removing contaminants. It applies to chemical and radioactive decontamination of personnel and equipment used in field investigations. All equipment must be decontaminated before use at the project site, prior to sample collection, and before being removed from the project site. Decontamination of personnel, sampling equipment (e.g., soil sampling equipment and submersible pumps) and heavy equipment (e.g., hollow stem auger rigs, backhoes) is required to ensure the health and safety of personnel, reduce the potential for sample cross-contamination, and reduce the potential for contamination to enter or leave the project site on personnel or equipment.

4.1 Decontamination

4.1.1 Location of Decontamination Activities

Decontamination activities may take place either in the exclusion zone of the investigation site or at a decontamination facility designed to contain larger volumes of potentially contaminated fluids and materials, or at a combination of the two. Decontamination activities conducted in the exclusion zone will be limited to washing of personnel and small sampling equipment using wash tubs or wipes. Scraping of PPE and large equipment to remove adhered clumps of soil will also be performed in the exclusion zone.

Decontamination of heavy equipment or equipment requiring high-pressure washing will be performed at a decontamination facility designed to contain large volumes of washing fluids. The decontamination facility may consist of an investigation area-specific temporary facility constructed near the investigation site, or a decontamination facility central to the project site that may be used for multiple investigations. If a central decontamination facility is used, sufficient decontamination of equipment will be performed in the exclusion zone prior to moving to the central facility to reduce the potential for deposition of contaminated materials on roadways between the investigation area and decontamination facility.

Decontamination facilities will be constructed to limit the potential for contact of potentially contaminated materials (decontamination sediment and fluids) with environmental media (i.e., soil or water) in the decontamination area. This will be accomplished by performing decontamination activities in lined and bermed areas, and by containing decontamination sediment and fluids as they are generated.

4.1.2 Personnel Decontamination

The following steps will be used to perform personnel decontamination:

- Soil adhering to boots, apparel and equipment will be scraped off at the sampling or excavation site.
- Boots and outer apparel that will not be damaged by water will be washed with Alconox low-sudsing detergent and potable water and scrubbed with a bristle brush or similar utensil (if possible). Apparel will be rinsed with potable water.
- Coveralls removed (if used).
- Hard hat and other safety equipment removed and washed with Alconox and rinsed with potable water.
- Gloves and respirator (if used) removed.
- Personnel shall wash hands, face, and forearms before eating/drinking.
- Following decontamination, apparel will be placed in a clean area, on clean plastic sheeting to prevent contact with contaminated soil. If the apparel is not used immediately, the equipment will be stored in plastic sheeting or heavy duty trash bags.

- Disposable PPE will be handled in accordance with Section 4.1.1 of the PWT Investigation Derived Waste Management SOP.

4.1.3 Small Sampling Equipment Decontamination

Small sampling equipment consists of split spoons, sample bowls, scoops, hand augers, filtering devices, non-dedicated pumps, water level meters, and other such small equipment used in the exclusion zone or the immediate vicinity of the sample collection location. Small sampling equipment is designed to be decontaminated at the sampling location using small wash tubs. Decontamination of small sampling equipment does not require high-pressure washing or steam cleaning, or result in production of large volumes of decontamination sediment or fluids.

The following steps will be used to decontaminate small sampling equipment:

- To reduce personal exposure, personnel will dress in suitable PPE in accordance with the HASP.
- Soil adhering to equipment will be scraped off at the sampling site and containerized.
- Equipment that will not be damaged by water will be placed in a wash tub containing Alconox or equivalent detergent and potable water and scrubbed with a brush. Equipment will then be rinsed initially with potable tap water and then with distilled water.
- Equipment that cannot be submerged in water (e.g., air monitoring devices, electronic devices) will be carefully wiped clean using a sponge and detergent water or baby wipes.
- Wash and potable rinse water should be replaced frequently. Decontamination sediment and water will be handled as investigation derived waste (IDW) (see Section 4.1.6).
- Disposable sampling equipment will be handled in accordance with PWT's Investigation Derived Waste Management SOP.

Following decontamination, equipment will be placed in a clean area or on clean plastic sheeting. If the equipment is not used immediately, the equipment will be covered or wrapped in plastic sheeting or trash bags.

4.1.4 Decontamination of Submersible Pumps

Submersible pumps used to conduct groundwater sampling will be decontaminated before being placed in the well. A decontaminated four-foot length of polyvinyl chloride (PVC) capped on one end will be utilized for this procedure. The following steps will be used to decontaminate submersible pumps:

- To reduce personal exposure, personnel will dress in suitable PPE in accordance with the HASP.
- Scrub the outside of the pump with a solution of Alconox or equivalent detergent and potable water and then rinse with potable water and distilled water.
- Fill the PVC tube with Alconox/potable water solution.
- Pump the solution through the submersible pump by lowering the intake tube of the pump to the bottom of the PVC tube. Be careful not to uncover the intake of the pump to prevent damage to the pump.
- Rinse the inside of the PVC tube with potable water to remove detergent and then fill the PVC tube with potable water.
- Pump the potable water through the pump.
- Repeat the rinse procedure with distilled water.

- Decontamination sediment and water will be handled as IDW (see Section 4.1.6 below).

Following decontamination, the pump will be wrapped in plastic sheeting or trash bags and placed in a clean area.

4.1.5 Heavy Equipment Decontamination

Heavy equipment used within the exclusion zone and/or for intrusive activities (e.g., drill rigs and associated heavy drilling and sampling equipment, backhoes, sampling-related vehicles) will be decontaminated upon arrival at the project site, between investigation locations (i.e., between boreholes and test pits), and prior to leaving the project site. The following steps will be used to decontaminate heavy equipment:

- To reduce personal exposure, personnel will dress in suitable PPE in accordance with the HASP.
- Prior to use at the project site and between investigation locations (i.e., between boreholes, test pits), the portion of the equipment directly exposed to potential contamination (e.g., augers, drill rods, backhoe bucket) will be decontaminated by pressure washing the equipment at the decontamination facility.
- Drill rigs and vehicles will not require pressure washing between investigation locations unless they have become substantially dirty as a result of drilling or investigation activities.
- Prior to leaving the project site, the portions of the heavy equipment potentially exposed to contamination will be pressure washed using potable water at the decontamination facility. Special attention will be given to removing any soil or other site-related foreign materials on the equipment.
- Decontamination sediment and water will be handled as IDW as described in Section 4.1.6 below.

4.1.6 Decontamination Sediment and Fluids

Sediment and fluids from decontamination activities will be initially contained and stored in approved water-tight containers at the sampling site or decontamination facility. Each container will be labeled with its contents and the date using a paint pen, or permanent marker. As soon as practical, decontamination sediment and fluids will be transferred from the sampling site to a designated IDW management area. Handling of IDW is addressed by PWT's Investigation Derived Waste Management SOP.

4.2 Equipment Rinsate Sampling

Equipment rinsate blank samples may be collected to verify the effectiveness of the decontamination procedures. Equipment rinsate blank sampling is usually performed for small sampling equipment, rather than heavy equipment. The frequency of rinsate blank sample collection, as well as the analysis methods, will be specified in the investigation-specific QAPP. In general, the rinsate blank sample collection procedure will consist of rinsing decontaminated equipment with laboratory-grade deionized water and collecting the rinsate water in sample bottles provided by the analytical laboratory. Special attention will be given to rinsing the portions of the equipment exposed to environmental samples or potential contamination. Rinsate samples will be handled in the same manner as environmental and other QA/QC samples in accordance with PWT's Sample Handling SOP. Rinsate sample collection will be documented in the same manner as environmental and other QA/QC samples.

5.0 DECONTAMINATION DOCUMENTATION

Field personnel will be responsible for documenting proper sampling equipment and heavy equipment decontamination. The purpose of documentation is to demonstrate in the written field record that decontamination was performed in accordance with this SOP. Decontamination activities will be documented at least each day they are performed. The documentation will be recorded in a logbook or on appropriate project forms (i.e., boring log, sample field data sheets). The information recorded concerning decontamination will include:

- Date and times of decontamination
- Location of decontamination activities (i.e., sample site, central decontamination facility)
- Decontamination personnel and materials
- Decontamination steps/observations
- Other applicable information

PWT STANDARD OPERATING PROCEDURE

SURFACE SOIL SAMPLING for INORGANICS Procedure No. PWT-ENSE-427
Revision 2
Date effective: 05/05/14

APPROVED: _____ 5/5/14 Page i of 10
PWT Project Manager, Date

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List of Attachments

Attachment A Surface Soil Sample Field Data Sheet

REVISION LOG		
Revision Number	**Description**	**Date**
0.0	Original SOP	June 2012
1.0	Edits to Section 4.2 Composite Samples	September 2013
2.0	Addition of Section 4.3 Rinsate Blanks	May 2014

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**

0.0	Annual QA Review	August 2013

1.0 PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used to collect surface soil samples for chemical analysis during environmental investigations. This SOP serves as a supplement to site-specific work plans and the site-specific Quality Assurance Project Plan (QAPP). This SOP may be used in conjunction with other SOPs. This SOP is not appropriate for sampling to determine concentrations of organic compounds.

The SOP describes procedures for collection of discrete samples (i.e., samples collected at a single point for chemical analysis), and composite samples (i.e., composed of multiple increment samples collected at several points within the area to be characterized) at multiple depths in 6 inch increments up to 24 inches (0-6", 6-12", 12"-18" and 18"-24"). Unless otherwise specified by the QAPP, the term "surface soil" refers to the top 24 inches of soil following removal of surface vegetation and other debris from the sampling area. Sample collection depths other than the ranges given may be specified by the QAPP.

2.0 REQUIREMENTS

The following sections identify the requirements for Quality Assurance / Quality Control (QA/QC), health and safety, and personnel qualifications for surface soil sampling.

2.1. Quality Assurance / Quality Control

Follow all QA/QC requirements identified for the project as specified in the approved project planning documents.

2.2. Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan (HASP), Job Safety Analyses (JSAs), any applicable Task-Specific HASPs prepared by PWT Subcontractors, and the associated Activity Hazard Analyses (AHAs).

A walkthrough shall be performed to identify any site specific hazards. Site specific hazards may include but are not limited to unidentified utilities such as underground propane lines, septic system drainfields, sprinkler systems, and owner placed electrical lines. Utility clearance will have been accomplished according to the PWT Utility Clearance SOP. Other site specific hazards may include low tree limbs, unleashed animals, ponds, and miscellaneous equipment.

2.3. Personnel Qualifications

Personnel performing surface soil sampling are required to have completed the initial 40-hour OSHA classroom training that meets the Department of Labor requirements 29 CFR 1910.120(e)(3)(i), and must maintain a current training status by completing the appropriate annual 8-hour OSHA refresher courses. Personnel must also have read and signed the appropriate HASP(s). Prior to engaging in surface soil sampling activities, personnel must have a complete understanding of the procedures described within this SOP and, if necessary, will be given specific training regarding these procedures by other personnel experienced in the methods described within this SOP.

Only qualified personnel will be allowed to perform these procedures. Required qualifications vary depending on the activity to be performed. If work is being performed by a subcontractor, the

subcontractor's project manager will document personnel qualifications related to this procedure in the subcontractor's project QA files.

3.0 MATERIALS AND EQUIPMENT

The following materials and equipment may be necessary for surface soil sampling:

- Laboratory-supplied sample containers
- Nitrile disposable gloves
- Bound field logbook
- Sampling site location maps
- 100-foot tape measure
- Measuring device such as small tape measure or calibrated instrument to identify sample hole depth increments
- Soil sample field data sheets (Attachment A)
- Approximate 3’ by 3’ plastic sheeting
- Surveying stakes or flags for marking of grid nodes and/or sampling locations
- Monitoring equipment and personal protective equipment (PPE) as outlined in the HASP
- Decontamination equipment and supplies (e.g., high pressure sprayer/washer, wash/rinse tubs, brushes, Alconox (or equivalent), plastic sheeting, paper towels, sponges, baby wipes, garden-type water sprayers, large plastic bags, potable water, and deionized water)
- Stainless steel scoops or spoons, knives, pick, and mixing bowls identified for each interval sample to be collected. Each bowl shall be clearly labeled for the sample depth range.
- Plastic or wooden ruler or graduated wooden survey lathe for measuring depth of holes
- Decontaminated drive sampler device with stainless steel liners
- Sledgehammer or slide hammer drive device
- Stainless steel shovels, breaker bars, picks for digging sample holes, (supplies may have to be purchased from an environmental supplier)
- Jackhammer with stainless steel (not carbon steel) bit, for hard soils, if allowed by the QAPP
- Sample collection supplies (e.g., plastic recloseable plastic bags or equivalent, waterproof markers, sample labels, chain of custody [COC] forms, cooler for sample storage, ice or ice substitute, clear plastic and strapping tape, custody seals, trash bags)
- Drums or other approved containers for containing investigation derived waste (IDW) soil and water

Other materials and equipment may be needed based on field conditions.

4.0 PROCEDURES

4.1 Discrete Samples

Discrete samples consist of samples collected for chemical analysis from a single location.

Sampling sites specified in the QAPP will be located and marked using surveying stakes, lath, or flags. Discrete surface soil samples will be collected as follows:

1. Place plastic sheeting in close proximity to the proposed sample hole. At each location, clear an area approximately 12 inches in diameter of surface vegetation and debris by cutting the shape of the sample hole through the vegetative mat with available shovel and/or handtools. The cleared vegetative material shall be removed as a mat and lose soil particles removed by shaking over the stainless steel container designated for the upper sample range. In the absence of vegetative cover (e.g. gravel driveway) proceed with Step 2.

2. Dig a 12 inch diameter hole to the required depth specified in the QAPP. Place measuring device inside hole and mark distinct sample ranges (surface to 6", 6"-12", etc.). Place soil material removed from the hole on the plastic sheeting in the order it was removed from the hole.

3. Use a decontaminated stainless steel spoon to collect the soil at the designated depths. Samples should be taken from the deepest sampling point first to minimize cross contamination from loose sample soil from upper sample points. The next sample point should be the next sample range up from the bottom of the sample hole. The process should be repeated until the top sample range has been sampled. A steel pick may be used as needed to loosen the soil. To the extent possible, eliminate gravel size or larger particles or debris based on visual observation. Be sure to collect sufficient sample volume to meet analytical requirements.

4. Place the remainder of the sample in a stainless steel bowl. To the extent possible, eliminate gravel size or larger particles or debris based on visual observation.

5. If the sample is to be homogenized, thoroughly mix the sample material in the stainless steel bowl using a decontaminated stainless steel spoon. To homogenize, divide the sample into four quarters and mix each quarter, then combine the four quarters and mix the entire sample.

6. Immediately fill the appropriate sample containers. Label and handle the containers as specified in the PWT Sample Handling SOP.

7. Decontaminate the sampling equipment in accordance with the PWT Personnel and Equipment Decontamination SOP.

An alternate method for collection of discrete surface soil samples involves the use of a decontaminated drive sampler with stainless steel liners. Because only one 6-inch liner can be filled at a drive location, this method may require several drives at adjacent locations to obtain the necessary volume of sample material to meet typical analysis requirements. This procedure will have to be repeated for each sample range to the full sample depth required.

1. Clear the sampling area, as per Step 1 above.

2. Using a sledgehammer or slide hammer drive device, drive a decontaminated drive sampler or other appropriate device containing stainless steel liners into the ground to the depth required by the QAPP. The process should be repeated at each drive location to obtain the required sample for the required sample depth.

3. Remove and open the sampler.

4. Log the sample in accordance with the PWT Borehole Logging SOP, if required by the project-specific QAPP.

5. Drive additional samples at adjacent locations to collect sufficient material for the analyses by repeating steps 1 through 5. Extrude the sample material from each liner for analysis into a decontaminated stainless steel bowl.

6. Once all the soil material is collected, thoroughly mix the soil sample material in the stainless steel bowl using a decontaminated stainless steel spoon. To homogenize, divide the sample into four quarters and mix each quarter, then combine the four quarters and mix the entire sample.

7. Immediately fill the appropriate sample containers. Label and handle the containers as specified in the PWT Sample Handling SOP.

8. Decontaminate the sampling equipment in accordance with the PWT Personnel and Equipment Decontamination SOP.

4.2 Composite Samples

Composite samples are comprised of multiple increment samples collected at several points. All or a portion of the increment samples are mixed together to create a composite sample representative of average constituent concentrations within the area to be characterized.

Prior to sampling, it is important to calculate the required volume of sample material to be collected at each increment sample location to ensure that the necessary amount of composite sample will be obtained. Required volumes of composite samples are analysis-specific and will be specified in the QAPP. For a given composite sample, the volume of each increment sample must be the same, and must equal 1/n of the required composite sample volume, where n equals the number of increment samples making up the composite sample.

Increment sampling locations specified in the QAPP will be laid out and marked using surveying stakes, lath, or flags. This typically involves staking a 5 point “star” pattern for 5 incremental sampling locations for an area, but may involve laying out a rectangular grid of points. The method for selecting incremental sampling locations will be described in the QAPP. Each composite surface soil sample will be collected as follows:

1. Place plastic sheeting in close proximity to the proposed sample hole. At each location, clear an area approximately 12 inches in diameter of surface vegetation and debris by cutting the shape of the sample hole through the vegetative mat with available shovel and/or handtools. The cleared vegetative material shall be removed as a mat and lose soil particles removed by shaking over the stainless steel container designated for the upper sample range. In the absence of vegetative cover (e.g. gravel driveway) proceed with Step 2.

2. Dig a 12 inch diameter hole to the required depth specified in the QAPP. Place measuring device inside hole and mark distinct sample ranges (surface to 6", 6"-12", etc.). Place soil material removed from the hole on the plastic sheeting in the order it was removed from the hole. Use a decontaminated stainless steel spoon to collect surface soil to a depth of 24 inches. A steel pick may be used as needed to loosen the soil. To the extent possible, eliminate gravel-size or larger particles and debris based on visual observation. **Important: Be sure to collect a sufficient volume of increment sample. The volume of increment sample collected at each location must be the same.**

3. Place the increment sample into a decontaminated stainless steel mixing bowl. Mix thoroughly.

4. Repeat Steps 1 through 3 at each increment sample location for a given composite sample, adding each successive increment sample to the stainless steel bowl.

5. Thoroughly mix the sample material in the stainless steel bowl with the stainless steel spoon used to collect all increment samples from that depth interval. To homogenize, divide the sample into four quarters and mix each quarter, then combine the four quarters and mix the entire sample. Place mixture into appropriate laboratory-supplied sample containers.

6. Decontaminate the sampling equipment in accordance with PWT's Personnel and Equipment Decontamination SOP.

7. Label and handle the containers as specified in the PWT Sample Handling SOP.

4.3 Equipment Rinsate Sampling

Equipment rinsate blank samples may be collected to verify the effectiveness of the decontamination procedures. Equipment rinsate blank sampling is usually performed for small sampling equipment, rather than heavy equipment. The frequency of rinsate blank sample collection, as well as the analysis methods, will be specified in the investigation-specific FSP. In general, the rinsate blank sample collection procedure will consist of rinsing decontaminated equipment with laboratory-grade deionized water and collecting the rinsate water in appropriate sample bottles. Special attention will be given to rinsing the portions of the equipment exposed to environmental samples or potential contamination. Rinsate samples will be handled in the same manner as environmental and other quality assurance/quality control (QA/QC) samples in accordance with PWT's Sample Handling SOP. Rinsate sample collection will be documented in the same manner as environmental and other QA/QC samples.

5.0 DOCUMENTATION

Personnel collecting samples are responsible for documenting sampling activities in the field logbook and on the Surface Soil Sample Field Data Sheet (Attachment A). Discussions of sample documentation are provided in the PWT Sample Handling SOP and the Borehole Logging SOP.

ATTACHMENT A

Surface Soil Sample Field Data Sheet

Surface Soil Sample Field Data Sheet

Inorganic Soil Sampling Field Form

Page 1 of ____

Project Information

Project Name:_____

Contractor:_____ Sample Technician(s):_____

Location Information

Location Identification Number:_____

Property Owner: _____

Property Address: _____

Weather:_____

Time of Arrival:_____ Time of Departure:_____

****

Sample Information

Sample Identification Number:_____

Property Subarea Identification or Description: _____

Sample Collection Method (circle one):

Spoon/Scoop/Trowel Drive Sampler Backhoe Other:_____

If Drive Sampler, identify liners used:_____

Sample Location Recorded (circle one): GPS Survey Field Sketch Other:_____

Sample Type (circle one): Discrete Composite

Sample Homogenized (circle one): Yes No

Total Sample Volume:_____ measurement units_____

Sample Depth:_____ measurement units_____

Sample Container: 4 oz glass jar 8 oz glass jar double Ziptop bagged Other:_____

Number of Sample Containers:_____ Preservative: $4^{o}C \pm 2^{o}C$ Other:_____

Analyses:_____

Sample Date:_____ Sample Time:_____

Associated QA/QC Sample Numbers:_____

Comments/Observations:_____

Samplers Name and Signature:_____

Aliquot	Cover	Soil Type	Volume of Sample Recovered (note units)
1			
2			
3			
4			
5			

APPENDIX B

TYPICAL RESIDENTIAL SOIL SAMPLING PACKET

Legend

- Sample Parcel
- Ownership Parcel
- East Helana City Limits
- US Highway

0 50 100 200 Feet

N

East Helena Superfund Site

Site Address	Site Owner	Date Sampled
602 Bayard Street East Helena, MT 59635	John Richardson	

Typical Field Diagram of Property

Imagery Source: Lewis and Clark County 2/5/2012

Path: H:\ENSE\RAC2\132 East Helena RD\GIS\Figure 2_Field Diagram of Property.mxd

East Helena Superfund Site OU2
2014
Soil Sampling Field Form

Site Code: _____ Date: _____ Time of Arrival: _____

Owner: _____ Time of Departure: _____

Property Address: _____ Public Present: _____

PWT Team Present: _____

Form Completion: Proj. Manager Signature/Date:_____

Total Sample Units at Property: _____

****

Sampling Unit: _____ Area: _____

Sample ID: Sample Interval (inches bgs):	Sample Time:	COC #: Shipping Tracking #(last 4 digits):
Aliquot	Ground Cover	Soil Type/Foreign Material Present
1		
2		
3		
4		
5		

QC Samples: □ Replicate □ MS/MSD

Sample Completion: Sampler Signature/Date: _____

Sampling Unit: _____ Area: _____

Sample ID: Sample Interval (inches bgs):	Sample Time:	COC #: Shipping Tracking #(last 4 digits):
Aliquot	Ground Cover	Soil Type/Foreign Material Present
1		
2		
3		
4		
5		

QC Samples: □ Replicate □ MS/MSD

Sample Completion: Sampler Signature/Date: _____

East Helena Superfund Site OU2
2014 Soil Sampling Field Form

Page ____ of _____

Site Code: _____ Date: _____Property Address: _____

****

Sampling Unit: _____ Area: _____

Sample ID: Sample Interval (inches bgs):		Sample Time:	COC #: Shipping Tracking #(last 4 digits):
Aliquot	Ground Cover		Soil Type/Foreign Material Present
1			
2			
3			
4			
5			

QC Samples: □ Replicate □ MS/MSD

Sample Completion: Sampler Signature/Date:_____

****

Sampling Unit: _____ Area: _____

Sample ID: Sample Interval (inches bgs):		Sample Time:	COC #: Shipping Tracking #(last 4 digits):
Aliquot	Ground Cover		Soil Type/Foreign Material Present
1			
2			
3			
4			
5			

QC Samples: □ Replicate □ MS/MSD

Sample Completion: Sampler Signature/Date: _____

Note: Identify and measure all sampling units

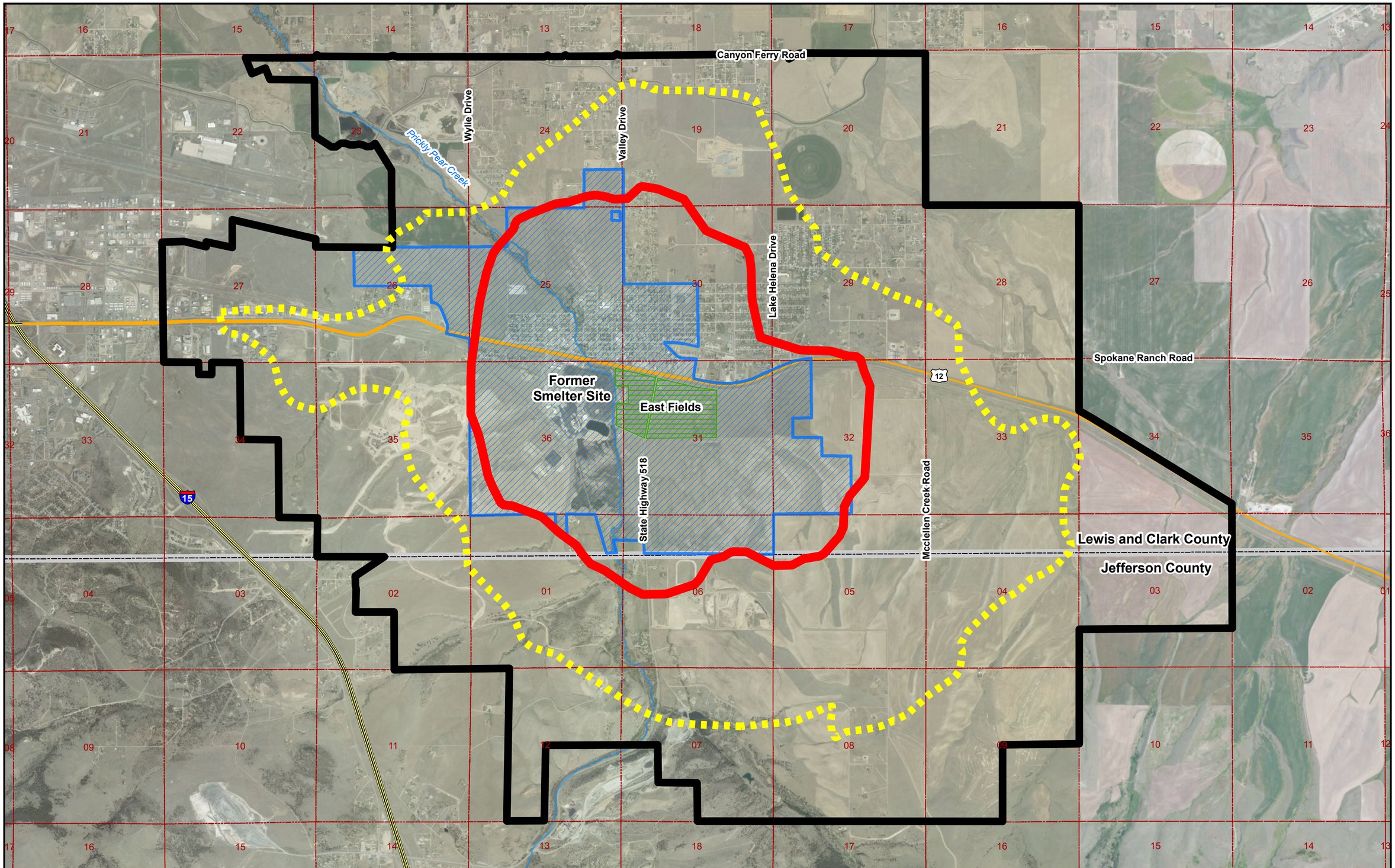
PACIFIC WESTERN TECHNOLOGIES, LTD.

Scale

East Helena OU2 Field Sampling Property Sketch Form

Site Code:
Address:
Owner:
Date:
Completion Signature:

FIGURES



Legend

- Estimated Distribution of Total Soil Lead - 500 mg/kg[1]
- Estimated Distribution of Total Soil Lead - 1000 mg/kg[1]
- OU2 Administrative Boundary[2]
- East Helana City Limits
- Township - Sections
- East Fields
- Interstate Highway
- US Highway
- County Boundaries
- Rivers and Streams

0 0.25 0.5 1 Miles

N

1 - Estimated Distribution of Total Soil Lead lines based on EPA's 2009 Record of Decision

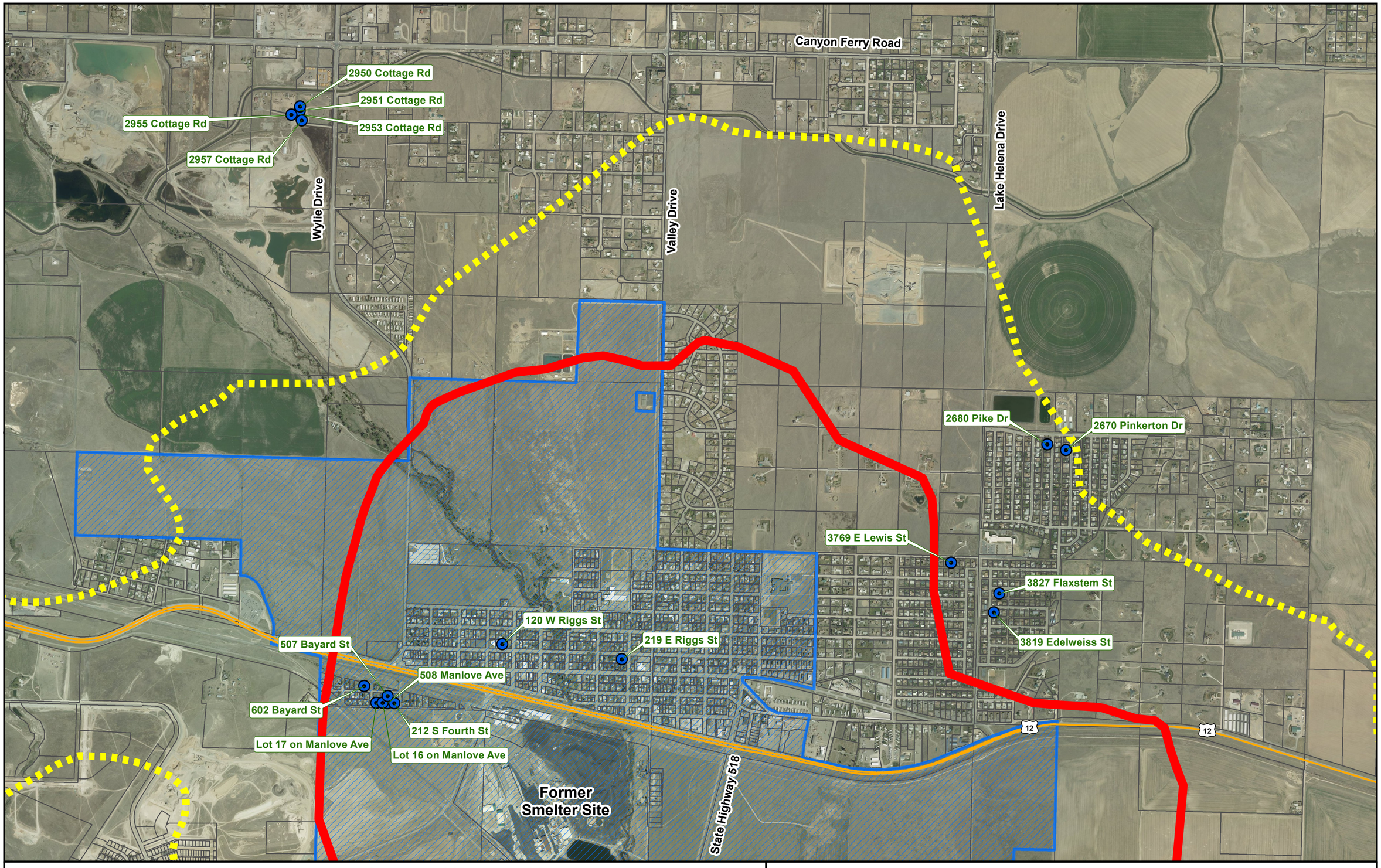
2 - OU2 is made up of Residential Soil and Undeveloped Lands not on Montana Environmental Trust Group land (except Lamping Fields, the Dartman parcel, and East Fields east of State Highway 518 which are all included in OU2)

East Helena Superfund Site

Figure 1 - Site Layout

PACIFIC WESTERN TECHNOLOGIES, LTD.

Path: H:\ENSE\RAC2\132 East Helena RD\GIS\Figure 1_SiteLayout.mxd



Legend

- Sample Location
- Estimated Distribution of Total Soil Lead - 500 mg/kg
- Estimated Distribution of Total Soil Lead - 1000 mg/kg
- US Highway
- East Helana City Limits
- Ownership Parcel

0 0.25 0.5 1 Miles

N

East Helena Superfund Site

Figure 2 - Proposed Residential Soil Sampling Locations

Imagery Source: Lewis and Clark County 2/5/2012

Path: H:\ENSE\RAC2\132 East Helena RD\GIS\Figure 2_Residential_Samples_20140603.mxd

TABLES

Table 1. Proposed Residential Property Sampling List
East Helena OU2 RD Soil Sampling
Field Sampling Plan

Property Address	Property Owner	Phone Number
2950 Cottage Rd East Helena, MT	Dale Mortieau	406-459-4496
2951 Cottage Rd East Helena, MT	Dale Mortieau	406-459-4496
2953 Cottage Rd East Helena, MT	Dale Mortieau	406-459-4496
2955 Cottage Rd East Helena, MT	Dale Mortieau	406-459-4496
2957 Cottage Rd East Helena, MT	Dale Mortieau	406-459-4496
602 Bayard East Helena, MT	John Richardson	406-672-0042
3819 Edelweiss East Helena, MT	John Jewell and Dianne Ducello	unknown
3827 Flaxstem East Helena, MT	William Franks and Sarah Rose	406-324-3387
508 Manlove East Helena, MT	Kevin and Kayla Montgomery	unknown
Manlove Addn, Block 5, Lot 16 East Helena, MT	Darwin and Deborah Curry	406-442-1095
Manlove Addn, Block 5, Lot 17 East Helena, MT	Darwin and Deborah Curry	406-442-1095
212 South Fourth St East Helena, MT	Verna Kroll-Crane	unknown
219 East Riggs East Helena, MT	Birgit Stipich	406-227-6682
3769 East Lewis St East Helena, MT	Raymond Leonhardt	406-250-6933
2680 Pike Dr East Helena, MT	Greg Olsen	406-439-9929
2670 Pinkerton East Helena, MT	Jeff and Esther Darling	406-860-3366
120 West Riggs St East Helena, MT	Roman Catholic Bishop of Helena	406-227-5334 or 406-227-6260
507 Bayard St East Helena, MT	Gayle Pocha	406-459-4442

Table 2. Sampling Unit Type List
East Helena OU2 RD Residential Soil Sampling
Field Sampling Plan

Sampling Unit Type	Sampling Unit Abbreviation
Front Yard	FY
Back Yard	BY
Side Yard	SY
Garden (flower/vegetable/fruit)	GA
Play Area	PA
Bare Area/Driveway	BA
Drip Zone	DZ
Opportunity Sample	OP

Table 3. Sample and Analysis Table
East Helena OU2 RD Residential Soil Sampling
Field Sampling Plan

Matrix	Analysis	Anticipated Concentration Range[1]	Laboratory Reporting Limits	Action Levels	Laboratory	Analytical Method	Sample Type	Duplicates & MS/MSD	Sample volume	Sample Preservation/ Holding Times	Container Size/Type	Total Number of Analyses
Soil	Arsenic	13 - 3,179 ppm	1 ppm	1,000/500 ppm [2]	EPA CLP	EPA Method 6010, ICP - AES	composite	1 per 20 investigative samples	8 oz.	Cool to 4° C (±2° C) immediately after collection/6 months	One 8 oz short, wide mouth, straight-sided, glass jar	358
	Lead	15 - 27,304 ppm	1 ppm	100 ppm [3]	EPA CLP	EPA Method 6010, ICP - AES	composite					358
Water (rinsate blanks only)	Arsenic	NA	10 ppb	NA	EPA CLP	EPA Method 6010, ICP - AES (200.7)	grab	NA	1 L	Acidify to pH < 2 with HNO3 and cool to 4° C (±2° C) immediately after collection, DO NOT FREEZE/14 days	1 L HDPE, cylinder-round bottle, 28 mm neck finish	15
	Lead	NA	10 ppb	NA	EPA CLP	EPA Method 6010, ICP - AES (200.7)	grab					15

1 Values taken from EPA/LEAP historical database from East Helena OU2

2 If any sampling unit contains soil lead levels greater than 1,000ppm, all sampling units within that property with soil lead levels greater than 500ppm will be remediated

3 Properties where the yard-wide average soil arsenic concentration exceeds 100ppm will be remediated, regardless of the soil lead concentration.

ICP-AES - Inductively Coupled Plasma-Atomic Emission Spectroscopy

ppm - parts per million

ppb - parts per billion

MS - matrix spike

MSD - matrix spike duplicate

EPA CLP - EPA Contract Laboratory Program

NA - not applicable